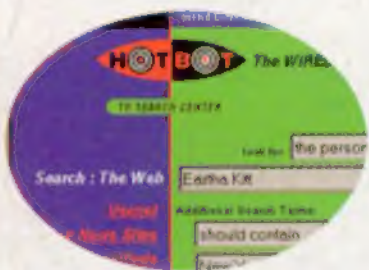


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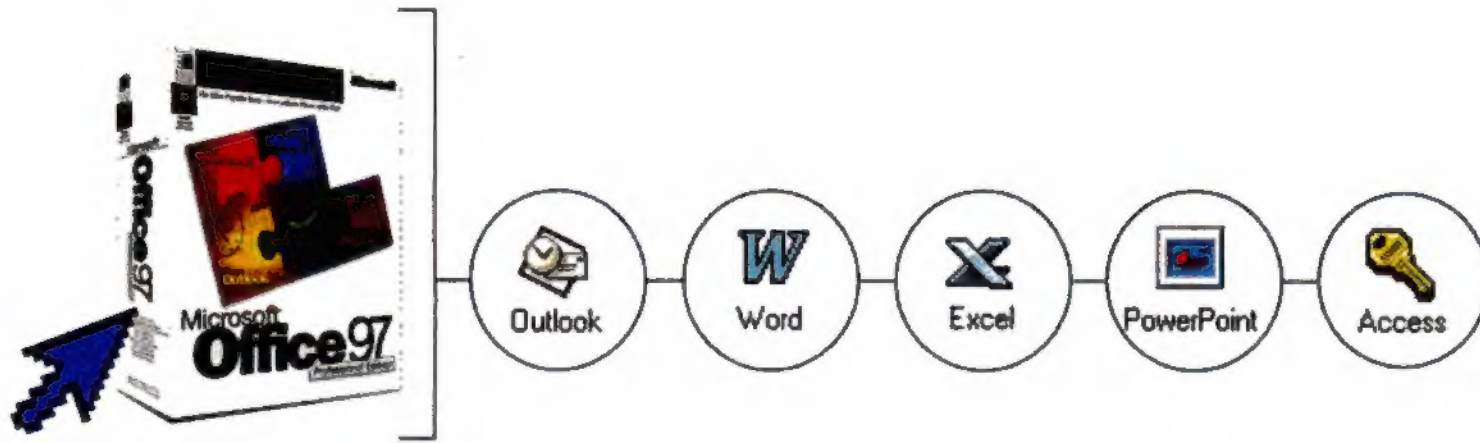
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A Hill of Beans



The continuing war of invective between Sun and Microsoft over Java started out being pretty amusing but is getting a bit tiresome. Yes, it is still entertaining to hear the latest one-liners from Sun's Scott McNealy and Javasoft's Alan Baratz about Microsoft's domination of the computer industry and its fear of Java.

And it's interesting to see the fervor with which Gates and the Microsofters deny all the bad things said about them. In fact, it's all good sport.

Except for one thing. Caught in the middle of all of this folderol are the people who want to develop software—and all of us who want to use their software.

This is particularly true in regard to the current lawsuit that Sun has filed against Microsoft over Microsoft's contract for Java. Sun alleges that although Microsoft's new version of Java in Internet Explorer fails to pass the Java compatibility tests, Microsoft distributed its version and claimed that it was compatible anyway. More specifically, Sun claims that Microsoft failed to include some new Java classes, extended the Java classes in ways that prevent code from being compatible on all Java platforms, made Java source code public, and falsely promoted its version of Java as compatible in order to fragment the market.

Microsoft, of course, denies these allegations. It has some specific rebuttals, but basically the company claims that its version of Java is the most compatible one out there. Clearly Sun and Microsoft are going to argue this out in a court of public opinion in addition to a court of law.

From an outsider's view, it seems that Microsoft has indeed violated the spirit of the agreement. You can argue that the two elements Microsoft didn't include aren't central to Java. And you can argue that Microsoft is allowed to extend the Java classes, and that applications developers know when they are doing things that aren't going to be cross-platform.

But there's little question that Microsoft doesn't see Java as a platform. Microsoft sees Java as a language and is defending its own Windows platform. And that puts

Microsoft at odds with Java.

Not that Sun is without blame. Although it promotes the standard as "open," Sun has been surprisingly closed about Java. Sun didn't want the contract made public, and it has thus far refused even to make its compatibility tests public (which seems to be in violation of the contract). And while Sun wants Java accepted as a standard, it still wants final

control over what's in Java. For instance, Sun hasn't been nearly as strong about ensuring compatibility with its other licensees, and so far, Microsoft is right in saying that it has developed the best Java VM.

Both Sun and Microsoft seem to think that in the future there will be one answer, one platform—either "Windows Everywhere" or Java with "Write Once, Run Anywhere." Not a chance. The reality is that there will always be multiple platforms, because different platforms have different strengths. Both companies know this, but neither seems to want to admit it.

Multiple platforms seem inevitable and good for users, because competition is healthy. But it would be good to have a method of running some software on all platforms, as Java promises. And that's what I'm worried about.

One possibility is that Microsoft will succeed in "splitting" the platform by using a nonstandard Java or by using its current implementation of Java in all future applications. Another is that Microsoft will cease shipment of Java, meaning that a lot of machines may not have Java, which would mean developers couldn't count on it.

We can argue about whether Microsoft or Sun wins in each of the scenarios. None of the solutions are good for users. We would be better off if the two companies could get along and agree to a standard. That way, individual platforms such as Windows would continue to evolve, alongside a method of writing programs that runs on multiple platforms. But I'm not holding my breath.

A stylized, handwritten signature of Michael J. Miller in black ink.

MICHAEL J. MILLER

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the Best PCs for '97 & '98

BY CADE METZ

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FEATURES

INTERNET

Your Complete Guide to Searching The Net



BY DAVID LIDSKY
AND REGINA KWON

So much information, so little time! We survey the entire Web search site landscape—including standard and metasearch sites, people finders, business finders, and more—to help you save time and aggravation as you hunt down essential information. Think about the kinds of searches you find yourself doing, then put one of these sites to work.....227

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New Technology, New Speed

BY JEFF MACE



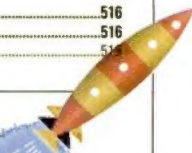
If you're in the market for a new graphics card, the choices have never been better. New 2-D/3-D chip sets deliver faster Windows rendering and better 3-D performance for the coming wave of 3-D-enabled business applications; the new AGP technology also enhances 3-D speed. We test 32 affordable graphics cards for home PCs, corporate desktops, and workstations.....261

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Pipeline



64-Bit Breakthrough

More than three years after Hewlett-Packard and Intel disclosed their plan to work together on a new microprocessor architecture, they've released the design's first technical details. The new instruction set, called IA-64, uses innovative techniques that elevate it beyond all of today's architectures and should result in stunningly fast performance.

The first chip to implement the architecture, code-named Merced, won't ship until 1999. The announcement, which Intel made during the annual Microprocessor Forum in San Jose in October, was just the start of a two-year striptease that will lead up to system shipments.

The chip will use 0.18-micron technology—one generation beyond Intel's most advanced process today—to fit more transistors in the same space. Intel is developing an even more advanced IA-64 processor, due to ship in 2001, that will be significantly faster than Merced.

Intel's goal with IA-64 is to dominate the workstation and server markets just as it dominates the desktop market today. It plans to develop new generations of existing processors for the indefinite future, and it doesn't view IA-64 as replacing them, at least in the next five years.

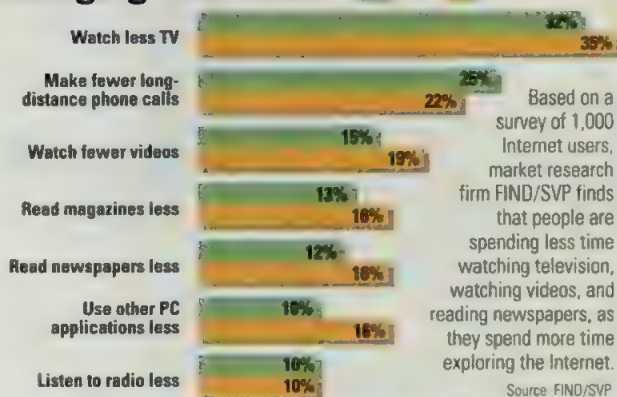
Intel traditionally has designed its processors so that it can lower their prices to about \$200 within two or three years and produce tens of millions of units per year. The first IA-64 processors, in contrast, will be designed for markets where performance is paramount, cost is secondary, and volumes are lower. Reducing the chips' costs for the more price-sensitive desktop market will take some time.

The architecture includes two key components: an entirely new 64-bit instruction set and an x86-compatibility mode. To benefit from IA-64 processors, programs will have to be recompiled for the new instruction set.

The 64-bit instruction set significantly improves on existing RISC designs by letting processors be built more simply and allowing for more highly parallel processors, which will thus be able to run at a higher speed. Three instructions are encoded in one 128-bit word, so that each instruction has a few more bits than today's 32-bit RISC instructions. The extra bits let the chip address more registers and tell the processor which instructions to execute in parallel. This approach simplifies the design of processors with many parallel-execution units and should let them run at higher clock rates.

Intel's goal is to dominate the workstation and server markets the same way it dominates the PC market today.

Changing Pastimes



The 1-Hour Intranet

More and more software seems to be free these days. The newest freebie is Microsoft's Office 60-Minute Intranet Kit, Version 2.0, downloadable at Microsoft's site or available on a CD. Designed for use with the company's Web authoring software Microsoft FrontPage98, the kit teaches you how to build and manage a



corporate intranet. It includes a Business Solutions Center module, containing 12 predesigned intranet Web sites for different kinds of businesses. You can drag and drop elements from the sites to design your own unique intranet. The typical user of the kit might be a member of a ten-person workgroup who has some experience with FrontPage, says product manager Andrew Dixon. He emphasizes that the product incorporates push and channel technology common to both FrontPage and Internet Explorer 4.0.

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Pipeline

Java Sparks Fly

When Sun Microsystems sued Microsoft in October for "failure to deliver a compatible implementation of Java technology" in Microsoft's Web browser Internet Explorer 4.0, a high-profile mud-slinging fest ensued.

The lawsuit contends that Microsoft altered portions of its browser code to steer users toward its Windows platforms. In announcing the suit, Sun's CEO, Scott McNealy—never one to mince words—said, "Java is a language but is also a platform, which Microsoft doesn't like. The company has decided this technology isn't good, because it won't lock anybody into Windows. It's like Kleenex being upset that there's a cure for the cold."

Charles Fitzgerald, of Microsoft's Java team, shot back: "Sun's claims are outrageous. Microsoft has delivered the most compatible implementation of Java on the marketplace and is well within the terms of our agreement. Sun has no ability to impact the shipment or deployment of Internet Explorer 4.0, and Sun has apparently decided that it can't compete in the marketplace."

Some analysts predict that the lawsuit will be settled out of court, but it will be difficult for observers to judge which company is right. Sun's Java compatibility tests are proprietary, making it impossible to determine exactly how Sun sees Internet Explorer as failing the tests.



Telecom Takeover

MCI Communications is the belle of the ball. The nation's number-two long-distance carrier now has three suitors—British Telecommunications (MCI's largest shareholder), GTE, and WorldCom—chasing after it.

Although MCI brings a range of services and operations to the table, its Internet backbone network (one of the fastest and largest in the world) is a particularly welcome asset. A marriage between any of the three telecom companies and MCI could have an impact on the Internet marketplace.

A blend of MCI and WorldCom would be particularly



powerful. Just one month after WorldCom announced a bid to acquire both ANS Communications (a unit of America Online) and CompuServe, it made a \$30 billion bid for MCI. In combination with assets from last year's buyout of

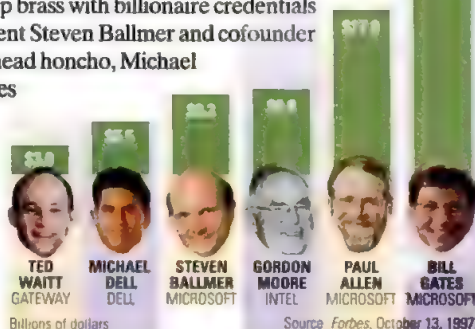
MFS Communications, which brought in UUnet's Internet backbone, such an acquisition could put WorldCom in a position to control much of the traffic on the Internet.

But according to industry pundits, there's enough competition in the Internet access market to prevent any major transformation overnight—especially in pricing. "It's a competitive marketplace, primarily because of the other telcos," says International Data Corp. analyst Jill Frankle.

Billionaires Club

If you're looking for an "in" to the billionaires club, check out the classifieds under "High-Tech." *Forbes's* 1997 survey of the 400 richest people in America lists 170 billionaires (a staggering jump from 1982, when the magazine reported only 13), 15 hailing from the computer industry.

Since last year's survey, Microsoft chairman Bill Gates' net worth has grown by an average of \$400 million per week. Other Microsoft top brass with billionaire credentials include vice president Steven Ballmer and cofounder Paul Allen. Dell's head honcho, Michael Dell, made his riches selling PCs direct; at 32, he's the youngest in the club and worth more than Gates was at the same age. Dell's net worth increased fivefold last year.



Dig Digital Cash?

When was the last time you groused about having too much cash in your wallet? Chances are, never.

But whether or not you have a cash or coin overflow crisis, Chase Manhattan Bank, Citicorp, MasterCard International, and Visa U.S.A. are out to make paper money and coins relics of the past. As part of a pilot project in New York City, they distributed 80,000 smart cards—credit card-like products that store cash value in embedded chips—to Upper West Siders and distributed smart-card readers to over 600 area merchants. The 36-block neighborhood west of Central Park is known for its concentration of retail outlets and for its desirable demographics.

The banks and credit card companies don't plan to cash in on smart cards anytime soon. Although they're not charging fees for the cards, they hope to add future fee-based applications.

The cards have a drawback: If you lose your smart card, you're out of luck. Anyone can spend the money stored on it, since it doesn't require a secret code or a signature.



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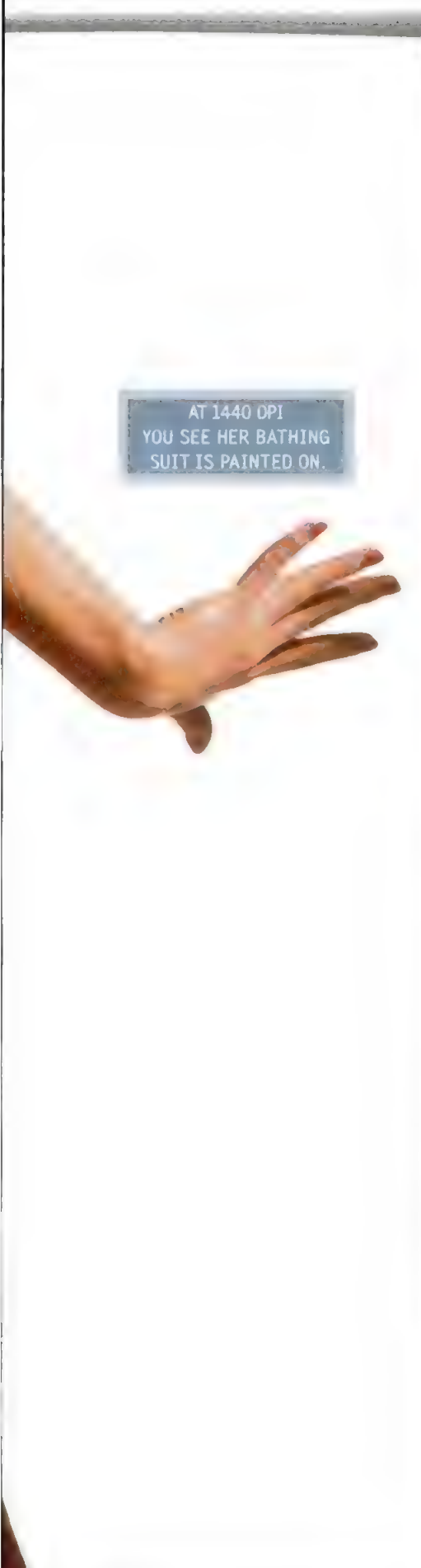
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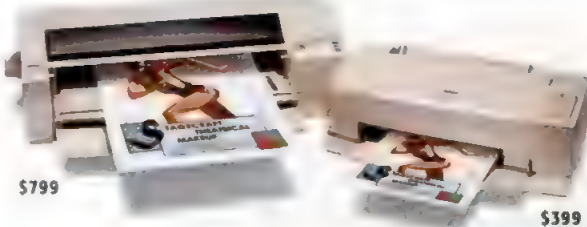


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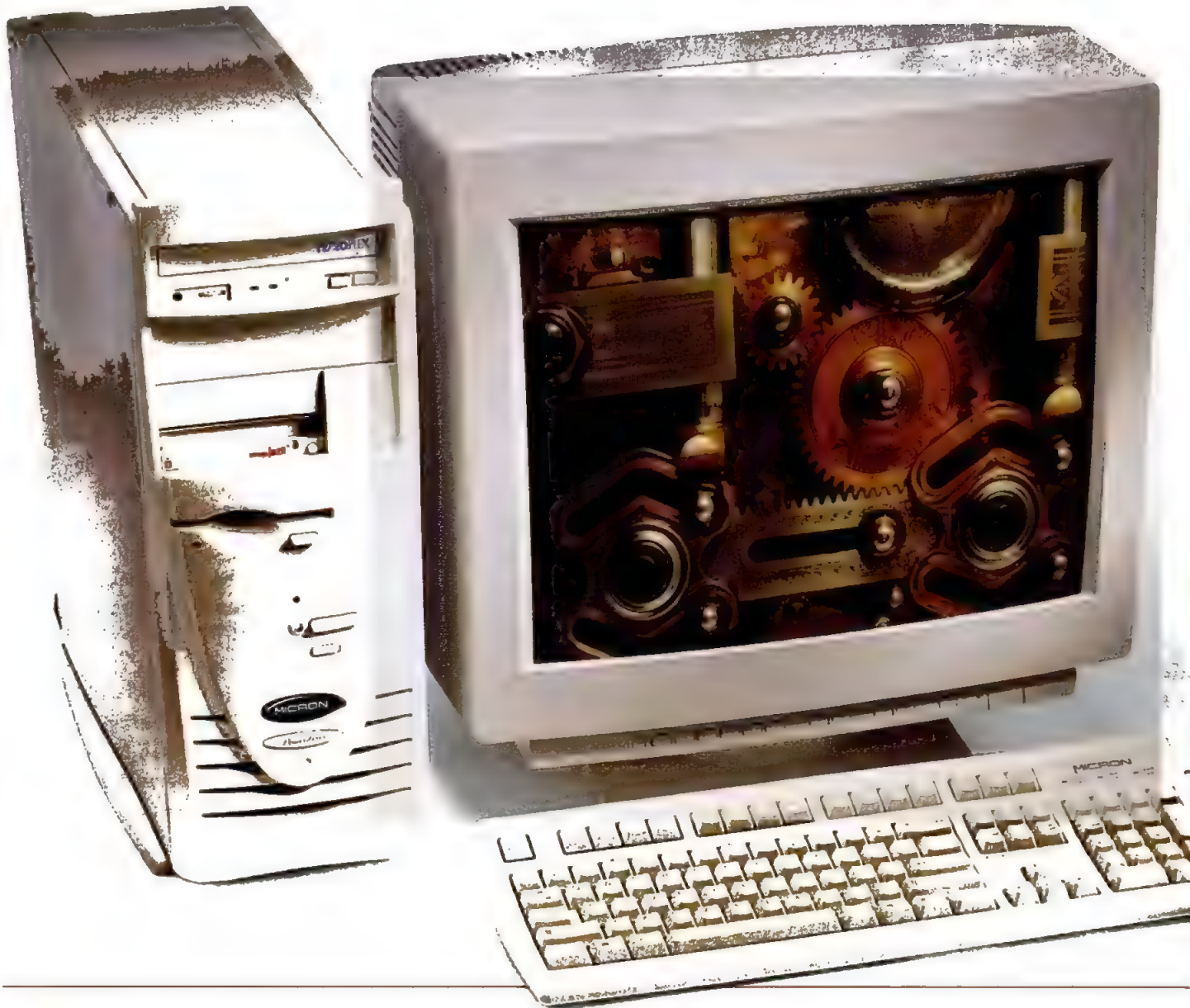
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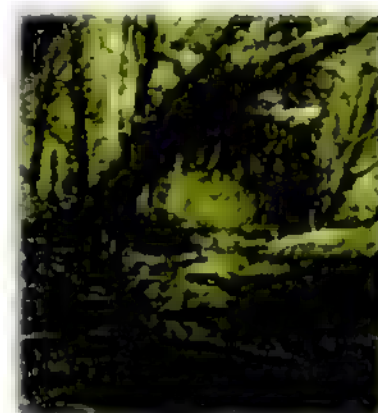


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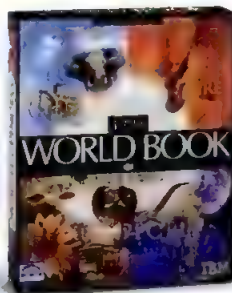
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Letters

HIDING INTERNET EYES

Jake Kirchner takes a popular stand on the issue of free speech on the Internet in his column "When It Comes to the Web, the ACLU Is Clueless" (October 7, 1997). But which became clueless first—the free-speech group, or the good-parenting group? They both have qualifiable responsibilities and limits. The majority of Internet users don't view either side to be as important as the battle itself, which keeps the real evil in check—that evil being total control of the Internet. Total control would be a disaster in the hands of either side.

TOM WOODWORTH
via the Internet

While Kirchner's comments about parental concerns and First Amendment rights appear reasonable, he does take cover in an assumption that many of us are unwilling to agree with. He seems to be saying that Internet conversations are commercial and not personal. The Internet is undoubtedly becoming more commercial, but the fact that it's also becoming less personal should be a matter of concern. Not everything one says on the Internet is meant to be public or commercial. To extend Kirchner's "sections of a bookstore" metaphor: Not everything I say to a friend in a bookstore is for public consumption, but do I have to step outside to whisper?

WILLIAM SELL
Milwaukee, Wisconsin

A big problem with censorship is that parents don't want to enforce it at the home front: They want to force it on everyone. When your children get drivers' licenses, do you expect the laws to be rewritten to fit their driving habits? Parents make a conscious decision to get connections to the Internet. Some of them just don't want to learn how to control material via a filtering program. If parents don't like what is on the Internet, they have the option of canceling their subscriptions. There are ISPs popping up that offer filtering of the Internet for people with children.

RICKY HARDT
Houston, Texas

Unlike Kirchner, I rarely agree with the ACLU. The pointless analogies made in his column are insulting. In any situation, anyone with half a brain can come up with an analogy to fit his or her needs. Simply because some parents are too lazy or disinterested in their children's activities to monitor their Internet adventures is no reason for censorship. The reason that these parents are like this in the first place is because of the ease with which they've found do-gooder social agencies will-



*Which became clueless first—
the free speech group or the
good parenting group?*

ing to raise their kids for them. Any kid who wants to view porn will find a way. Zoning codes and the like do not change this. Porno Web sites don't jump onto your computer when you turn it on. You have to go looking for them, unlike in the real world, where porn and drugs can and do come to the children.

DANA BOOTH
via the Internet

Kirchner says he wants to make the Internet a "safe medium to have in our homes." The untested and never directly stated assumption behind his entire argument is that children can be injured by things they find on the Internet. To me, that seems like a proposition of fact that could be scientifically tested rather than a self-evident truth. Talk of censorship should abide a careful exploration of whether the material it would protect us from can hurt anyone.

JEFF SCOTT OLSON
Madison, Wisconsin

POOR QUALITY BEYOND SAD

John C. Dvorak's column "Clunker-Caliber CPUs" (October 7, 1997) is directed at the lack of quality in recent releases of software and hardware. His conclusion: "It's sad."

Sorry, it's a lot more than sad. CPUs are increasingly performing mission-critical—even life-critical—functions. The latest generations of CPUs are essential to flying aircraft, among other uses. It's only a matter of time before the government, as an issue of public safety, imposes quality standards. When Intel's Andy Grove remarked of the original Pentium bug, "Well, it's not like it's doing mission-critical

work," he showed that he really doesn't grasp what end users are doing with chips.

TRYGVE ANDREASSEN
Denver, Colorado

GETTING HOOKED UP

In Bill Howard's October 7 column, "The Cable Modem Guy," it's clear he's very enthusiastic about cable modem technology. But his enthusiasm won't last. Let's get past the issues of the extra monthly cost and the hassle of having a new cable line run into your house. The key issue is that the available 5-Mbps bandwidth is shared. Most major urban centers in Canada have had cable modem service available for at least a few months. It is fast. But like many home PC users, I can expect the heaviest drains on this shared cable-system bandwidth at about the same time of the day or week that I want to use the system. The two cable companies in my town have allocated about 2,000 users per node. If 300 of the users are online and a third of them are downloading large files from Web pages, that would leave me with $1/100$ of the 5-Mbps bandwidth, or 50,000 Kbps. I regularly connect at over 50,000 Kbps using a U.S. Robotics 56K modem. Cable modems will be great, until they get popular.

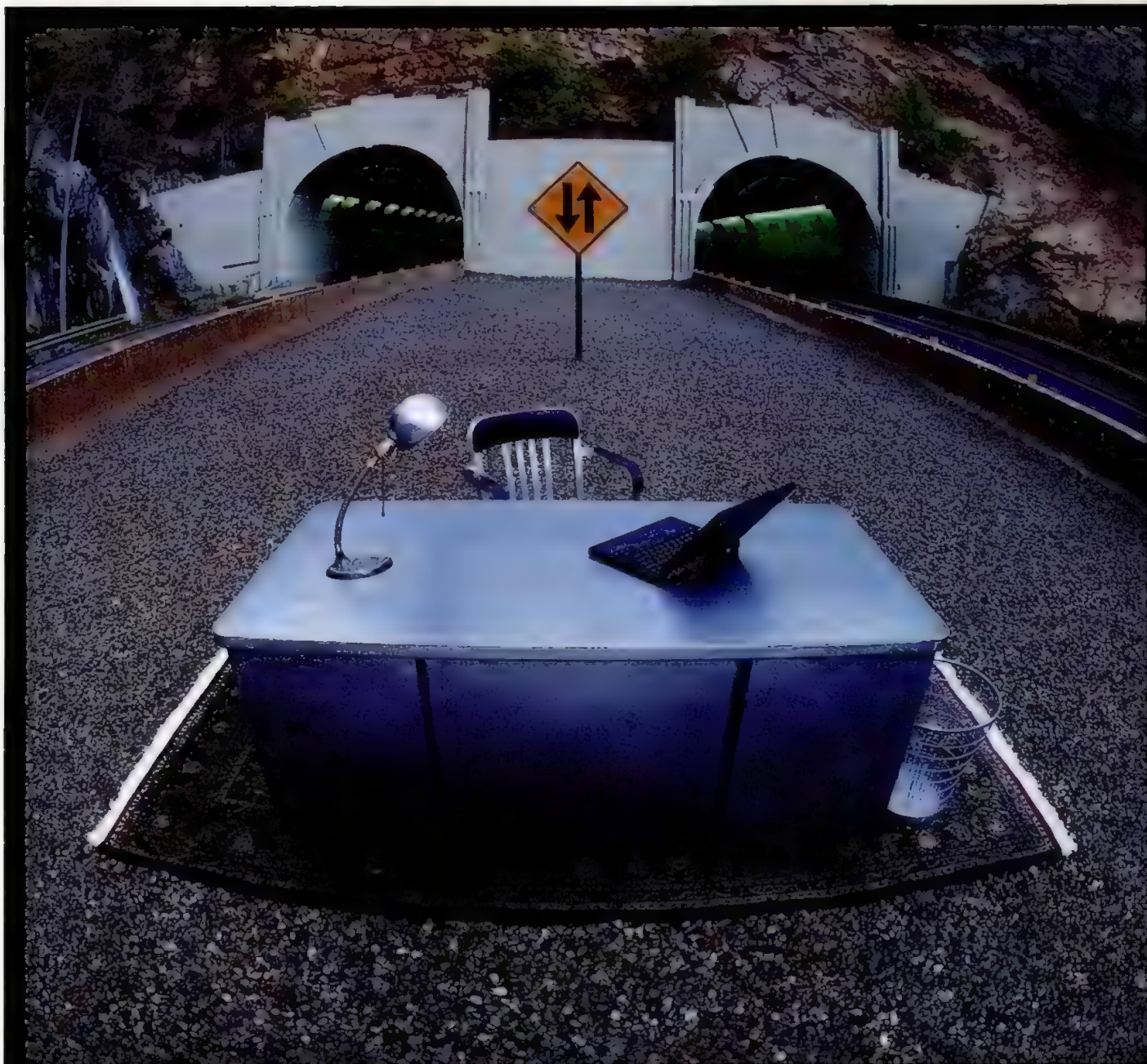
FRED PALMER
via the Internet

Howard left out price as a factor to be considered in switching to cable modem service. A lot of us might have a second phone line that we no longer need, so we would essentially break even. Also, there is a less tangible reason for switching. U.S. Robotics has created a lot of ill will with its hype, misrepresentation of x2, overpriced upgrades, confusing special offers, disappointing performance, and enticement of new customers at the expense of existing customers. I am sure that there are many like me who are fed up with the whole analog modem business—thanks to U.S. Robotics—and would gladly embrace a different technology. My only regret in switching to cable modem service is that I would lose my ISP, Mindspring, and the wonderful technical support it has given me.

GEORGE A. KIRKMAN
via the Internet

CONTENT AND KILLER SPEEDS

As usual, I read Bill Machrone's column ("Speed Kills: The Dial-Up Internet," October 7, 1997) with interest, but I feel he's kind of missing the point of cable modems, or of any high-speed link. Let's settle for getting current content at decent speeds before worrying about services that encourage streaming video and audio. We can all listen to the radio



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Letters

or watch TV. Far too many Web sites concentrate on flash graphics and logos that actually add nothing to Web content except bigger delays and bandwidth problems. The future of the Internet lies in its appeal to the mass market, and that means more than just the U.S. domestic market. Companies selling across the Web should be aware of that, and also that the rest of us pay for connection to the Web by the minute. We may have unlimited access to an ISP, but we still pay for phone connections. Large-scale use of streaming audio, or even of fancy graphics, will be popular on a large scale only if it adds value to the experience—and it rarely does.

PHIL EVANS
London, England

Machrone's editorial is right on the money. The Internet is essentially a lot of copy and a few graphics. When are the powers that be going to comprehend that video and audio are what we want? Imagine the educational and entertainment value of the Internet if one could tour the pyramids of Egypt or the streets of Paris by watching video and audio over the Internet. Innovative and talented videographers would flood the market with sorely needed material that we can only dream about now. When will affordable high-speed data transmission become a reality and free us from antiquated phone lines?

TOM BASHAW
via the Internet

"DOH!" TO ADVERTISING

A congratulatory clap on the back and a great big Homer Simpson-style "woohoo" to Bill Machrone for his September 9 column "The

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CORRECTIONS AND AMPLIFICATIONS

In the October 7, 1997, Trends story "One-Stop Utility Shop" (page 28), we incorrectly implied that the Carolina Power & Light subsidiary CaroNet offers Internet access to end users. The company provides wholesale bandwidth to several ISPs.

In the October 7 article "Big Screens, Low Prices," Scott Peterson should have been credited for all the photographs of the monitors.

In our October 7, Pipeline article "High-Speed Cryo-chips" (page 10), the reference to -196°K should have read -196°C.

Marketers Have Gone Mad." It's about time someone stood up and mentioned the fact that advertising has hit the lowest of low points. For years I have wondered whether consumers on the whole have lost the ability to discriminate among products on the basis of quality and craftsmanship. I am utterly disgusted that there are people out there who would actually buy a product because someone made it look fancy or dazzling on TV or in a magazine, even if the product itself is completely worthless.

SEAN SUNLEY
Regina, Saskatchewan, Canada

REDUNDANCY

I'm a regular reader of your magazine, mostly for the columns. I am especially fond of Dvorak's articles, but I have noticed lately that he'll write about a topic and then Jim Seymour will write about the same topic with a totally opposite opinion (or worse, exactly the same opinion). In the October 7 issue, Dvorak (Inside Track) and Seymour ("Microsoft/Apple: A Win-Win Deal") both wrote about Microsoft and Apple. In the same issue, Howard and Machrone wrote about cable modems. While I appreciate seeing another opinion or two sides of a story, it really can be redundant. Perhaps, with five columnists, you could report on different subjects such as IRC (Internet Relay Chat) or many of the other events that are happening around us.

MATT HALLACY
via the internet

AVERAGE HIGH LIFE

In your October 7 Pipeline section you laid out what are supposed to be "averages" for various technology workers ("Career Advice"). I think there is a large slice of reality missing in these "average" salaries. The lowest listed salary (for help-desk positions) came to \$66,976 a year, and the highest was that of programmer or analyst at a whopping "average" of \$191,776 a year. If these are averages, then I'm due for a raise.

PAUL DOHERTY
VIA THE INTERNET

MONITORING WHO BUYS WHAT

Why do you persist in believing that everyone out here is made of money? The latest

example is your review of monitors ("Big Screens, Low Prices," October 7, 1997) where, once again, you fail to review any screen smaller than 17 inches. Believe it or not, some people actually buy 15-inch monitors. We take our purchases seriously and would like good reviews to aid in our decisions. Please come down off the mountain now and then, and try to see the computing world from the perspective of those of us with ordinary budgets.

JEFF WENN
London, Ontario, Canada

I think weight is a factor that should be covered on a continuing basis, not merely as it relates to shipping cost. I have a hard time getting a 17-inch monitor up a flight of stairs in my home or reaching widely to perch it in the remote corner of my workspace. I'm afraid the 19-inch monitor would be worse.

FRED BAUER
via the Internet

SHOCKING INFORMATION

Your review of UPSs ("The Power Brokers," September 23, 1997) provided a great deal of useful information about the products tested. In one regard, however, I felt that the article fell short. The section on "Determining Your UPS Needs" gave a few example configurations, with recommended UPS ratings. I think your readers would have benefited more from an explanation of what the va (volt-ampere) ratings on UPSs actually represent and how to use them to ensure that a given UPS is sufficient for the loads attached. Va ratings are, in my opinion, a minor hoax. Electrical power is measured in watts, not volt-amperes. Watts are indeed calculated by multiplying volts times amperes, but the values used for volts and amperes are RMS (root-mean-square) values—a kind of average of the amplitude of the sine waves. Volt-amperes, on the other hand, are calculated by multiplying RMS volts times peak amperes. Since the amperage sine wave is measured at its very peak instead of its average value, a UPS rating given in va appears much higher than if given in watts.

RICHARD KOETT
via the Internet

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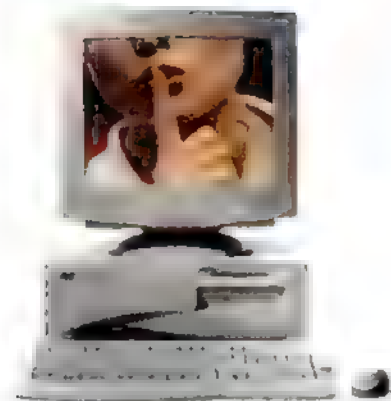
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Trends



Comdex Close Up

From palmtop PCs to way-cool Web tools, it's show time!

Sure as a microprocessor's clock cycle, the computer industry makes an annual pilgrimage to the gigantic Comdex trade show in Las Vegas every November, where it showcases the latest computer gear to tens of thousands of attendees and teases them with previews of future high-tech products. We've cut through the hype and uncovered just a few of the hardware and software products in the spotlight.

With Version 2.0 of Windows CE, Microsoft brings its technology for tiny operating systems not only to handheld PCs but also to smart phones, set-top boxes, and DVD players; eventually the technology will also apply to car computers, and wallet PCs. Windows CE 2.0 supports color displays and e-mail attachments, and it offers better connectivity and synchronization options. It also offers features for "embedded systems," including "demand paging" for executing programs that

don't fit in available memory, support for local embedded applications, and support for real-time task scheduling.

In early 1998, Microsoft is expected to introduce two offshoots of Windows CE aimed at small devices for electronic payments and scheduling, such as wallet PCs. CEO Bill Gates is likely to discuss these operating systems—code-named Gryphon and Mercury—in his Comdex keynote, although Microsoft is not displaying them publicly at the show.



SHARP-SHOOTER: Make that one digital camera to go.

MULTIMEDIA, IN THE PALM OF YOUR HAND

LG Electronics, Novatel Wireless, and Sharp are among the ten hardware companies serving up a fresh batch of Windows CE 2.0 handheld computers to hungry Comdex attendees. Sharp's 14.4-ounce Mobilon has a color screen, an optional PC Card digital camera, and a voice recorder for recording memos without opening or turning on the unit. The combination lets you send multimedia e-mail over the 33.6-Kbps modem by snapping a picture with the camera, adding a voice-over, and attaching both to an e-mail message. The high-end model in LG Electronics' Phenom line includes a CDPD wireless modem. Color screens will be available in early 1998.

Meanwhile, IBM is showing off the new WorkPad—its own version of the PalmPilot,



COLORIZED: New Windows CE 2.0 devices now have color displays.

licensed from 3Com. And Motorola, PageMart Wireless, and 3Com are using the Palm Pilot's phenomenal market success as a launching pad for a new wireless accessory.

The Motorola PalmPager, on display at Comdex but not shipping until the end of the year or January, is a fully functional alphanumeric pager in the form of a 2MB PC Card that slips into the PalmPilot. It provides one-way paging to the PalmPilot as well as e-mail notification, news and weather reports, and stock updates.

Over in the software department, companies including Macromedia and Microsoft are launching next-generation Web development tools that let professional and novice designers create cyber-sites.

Following the widely acclaimed Director, Flash, and Shockwave, Dreamweaver is Macromedia's new entry into interactive media. It's a souped-up HTML editor that supports Dynamic HTML, including Cascading Style Sheets (CSS), CSS Positioning, and the Document Object Model. By integrating Dynamic HTML support for both Microsoft Internet Explorer 4.0 and Netscape Navigator 4.0—which have differing versions of the proposed standard—Dreamweaver eliminates the bane of Web designers' lives: cross-browser incompatibility. A prerelease version is available at Macromedia's Web site.

Dreamweaver is sharing the stage with FrontPage 98, the newest version of Microsoft's Web site creation and management tool. The enhanced editor has WYSIWYG tables and frames and a redesigned FrontPage Explorer, which includes a new Navigation View to help you plan and organize your site and

generate Navigation Bars and hyperlinks. FrontPage 98 also supports Channel Definition Format (CDF) for pushing information from your Web site to users, and like Dreamweaver it supports Dynamic HTML. A prerelease version is available from Microsoft's Web site.—Carol Levin, Angela Hickman, and Sebastian Rupley



UNDER WRAPS: Will the PalmPilot and WorkPad go wireless?

Apple Delivers Rhapsody

Developers get first dibs on the long-awaited new operating system.

At the recent Seybold conference in San Francisco, interim Apple CEO Steve Jobs confirmed that Apple is still on track to release Rhapsody, quelling rumors that the company might shelve the operating system and promote its Macintosh OS 8 instead. Apple has already delivered a Rhapsody release to over 10,000 developers and plans a wider release of the developer version in November. The final version is slated to ship in mid-1998. According to Jobs, Rhapsody's performance "is going to scream."



Contrary to rumors that Rhapsody might be a specialty operating system solely for stripped-down network computers from Apple, it's actually targeted at servers and high-end clients, says Jobs. The company doesn't intend to migrate users from Macintosh OS 8 to Rhapsody. Rhapsody looks as though it will be delivered similarly to Microsoft Windows NT, which is also aimed at high-end users and servers.

Apple designed Rhapsody as a cross-platform solution to run on both x86 PCs and PowerPC-based machines. The core microkernel is the Mach 2.5, and the operating system is based on BSD Unix 4.4. It's a preemptive, multithreaded OS with support for symmetric multiprocessing. The multimedia-smart system also includes Apple's QuickTime, QuickTime VR, and QuickDraw 3D players.

Rhapsody's core architecture comes from NeXT Computer's operating system OpenStep. The NeXT technology may provide an advantage in facilitating sophisticated applications built from distributed objects. Rhapsody also includes Apple's "Blue Box subsystem," a port of the Macintosh OS source code that will let the operating system run most Macintosh applications.

Initially, Apple won't position the OS as a migration path for current Macintosh users. Instead, the company will market the two operating systems separately, just as Microsoft has marketed Windows NT separately from its other versions of Windows.

—Sebastian Rupley



Advanced Graphics Port: What Speed Improvements?

CURRENTLY, MOST OF THE PCS THAT IMPLEMENT Intel's Advanced Graphics Port (AGP) make good on its objective only in part. Of the 97 corporate systems we reviewed for this issue's cover story ("The PC Lines Are Drawn"), 16 included graphics solutions with AGP functionality; each system could use AGP's 66-MHz link to the system chip set, but only one benefited from AGP Texturing, an important feature that accelerates 3-D texture mapping. (For a full description of AGP, see "Introducing AGP," September 23, 1997). Until AGP implementations improve, a graphics card using the PCI bus will still be a comparable solution for corporate buyers.

A standard graphics card using the PCI local bus runs at only 33 MHz, half the speed of the main memory bus (a bridge between the CPU, chip set, and main memory). One key AGP function is to take the graphics card off the PCI bus and let it talk directly to the system chip set at 66 MHz. Theoretically, this not only speeds graphics data transfers but also gives the PCI bus bandwidth for other operations.

The AGP systems used five graphics solutions: the ATI 3D Rage Pro, Diamond Viper V330, Matrox Millennium II, Number Revolution 3D, and STB Velocity 128 3D. Though each card uses the AGP slot and talks to the system chip set at 66 MHz, the cards are no more adept at 2-D graphics than their PCI counterparts, as measured by our 2-D-oriented benchmark tests Graphics WinMark and Winstone. The Millennium II and the Revolution produced above-average Graphics WinMark scores, but many of the leading performers used PCI cards. Though the PCI bus runs at only 33 MHz, its 100-Mbps bandwidth had no problems handling the graphics data in our

2-D benchmark tests. Many graphics board vendors admitted we would see little if any difference between their PCI and AGP boards in Winstone results.

TEXTURING TEST

AGP systems fared no better during our 3-D testing, for only one could accelerate texture mapping by using AGP Texturing. The Millennium II and the Revolution, though admirable 2-D performers, are not yet capable of AGP Texturing. These cards, essentially PCI devices redesigned to use the 66-MHz AGP slot, benefit from the additional bandwidth but support few other AGP-specific features. The Rage

Pro, Velocity, and Viper support AGP Texturing but only when accompanied by three particular pieces of software. Only two of the seven systems to use these cards arrived at PC Labs with all three items loaded.

One of these PCs—Mega Computer Systems' Impact Pentium II 266 AGP—was still unable to use AGP Texturing, for the company improperly implemented the primary graphics card driver. On our 3D WinMark—

which calls for large 3-D texture maps at certain points—the system produced scores that were well below average. Not surprisingly, the leading 3D WinMark performer was the sole machine to implement AGP Texturing correctly—the Dimension XPS D266, from Dell.

Eventually, as mainstream applications become more dependent on photo-realistic 3-D textures, AGP solutions—combined with larger frame buffers and larger on-chip texture caches—will be required. At the moment, though, most AGP implementations are still a bit immature and afford little advantage over PCI graphics.—Cade Metz

3-D THRILL:
The Dell Dimension outdid the average AGP PC by over 130% on our 3D WinMark tests.



AMD's CPU Surprise

Intel's Pentium II chip is headed for some competition, two years from now.

Attendees at this year's Microprocessor Forum—the premier event for the introduction of new microprocessors—were given quite a shock by keynote speaker Jerry Sanders, CEO of AMD. Sanders showed a slide of AMD's next-generation K7 processor. And if not for the AMD logo printed on the package, you'd think it were a Pentium II.

Intel's Pentium II (introduced earlier this year) broke from the Socket 7 design, which all previous-generation Pentiums used. With this CPU, Intel introduced a new interface that it calls Slot 1. In a Slot 1 design, the processor, L2 cache, and north bridge of the PCI chip set are mounted on a printed circuit board (PCB). The PCB is encased in a metal cartridge, which plugs into the motherboard via an edge connector. The entire rectangular package functions as the

processor, as Intel doesn't sell the CPU separately.

Other makers of x86-compatible processors—including AMD, Cyrix, and new player IDT/Centaur—have had to stay with the Socket 7 interface. That is because Intel has not licensed Slot 1 or, more importantly, the P6 bus to any other microprocessor manufacturer. In view of AMD's lengthy legal battles with the CPU behemoth, which were only recently settled out of court, Sanders's slide of the future K7 (scheduled for release in 1999) came as quite a shock.

The K7—as shown—is a circuit board inside a cartridge, exactly like the Pentium II. Although the AMD CEO didn't provide many details, the picture showed a module identical to the Pentium II and a circuit board with a centrally mounted processor and two chips mounted on either side of it; these appeared to be L2 cache chips, just as in the Pentium II.

Sanders claimed that the K7 will be me-



chanically identical to the Pentium II and that the cartridge itself will fit into Intel's Slot 1. The major difference that Sanders pointed out is in the bus interface. The K7 will use the Alpha EV6 bus protocol, which is used for Digital Equipment's forthcoming Alpha 21264 microprocessor; it won't employ the P6 bus interface, which the Pentium II uses.

According to Digital representatives at the Microprocessor Forum, the use of the EV6 bus protocol also means that PC manufacturers could mount an Alpha 21264 processor on a PCB, put the PCB in a metal cartridge, and plug it into Slot 1. This is an intriguing prospect, in that PC vendors could take the most advanced microprocessor design on the market and plug it into a mainstream PC.

What all this will mean to Intel (or its attorneys, more specifically) is anyone's guess, given that the introduction of the K7 is still two years away. AMD won't disclose further details of the K7 until next year's Microprocessor Forum.—Carol Venezia

JAKE KIRCHNER

Lawsuits Are Bad for Business Ties

There's nothing entrepreneurial about a lawsuit, particularly when the litigants are business competitors. This helps explain why in the computer industry, at least until recently, such lawsuits have been relatively rare.

On a practical level, lawsuits move so slowly that the immediate issues tend to become irrelevant in the innovative rush of the PC business. And customers hate it when their suppliers take disputes to court; they wonder whether the complaining companies are compensating for misdirected product strategies and failed business plans. Moreover, the customers wonder whether they too will be hauled into court the next time they have a disagreement with those vendors.

Perhaps most important, resorting to litigation is seen as a sign of weakness. The leading executives in this business have cultivated a swashbuckling, one-man-against-the-world image that doesn't square with hiding behind the skirts of justice. Two recent cases make that point: Borland's suit against Microsoft for allegedly raiding its staff for key employees and Digital Equipment's patent infringement case against Intel. In both instances there was a widespread feeling in the industry that the companies ran to court because they couldn't prevail in a very competitive marketplace.

Which brings us to the suit du jour. Sun Microsystems' case against Microsoft for allegedly breaching their Java license agreement. There's no doubt that serious issues are involved here for both companies. Sun has tied its future to Java, so there's nothing frivolous about the dispute. And to their credit, Sun officials did try to negoti-



ate a resolution with Microsoft. But most of us wish they had tried a little harder.

Moreover, there's a real sense around the industry that Sun backed itself into a corner through excessive saber rattling. Although it readily granted Microsoft a license for Java, Sun clearly never thought of Microsoft as any kind of business partner. Indeed, Sun got caught up in publicly and loudly portraying Java as a Microsoft-killer. When Microsoft didn't appear willing to help bring about its own demise, Sun suddenly ran off the field of battle to court. Or at least that's the way it looks to most of the public.

As with other such suits, it seems unlikely that the dispute can be resolved through the legal system—at least anytime soon. Perhaps the suit was primarily an escalation of the negotiations and may lead to a peaceful resolution between the companies. Microsoft doesn't want to spend the next five years in court over this issue.

No matter what the outcome, the suit isn't doing Sun much if any good. It's bound to dim Java's reputation in the community and make potential developers and corporate adopters think twice about working with the software. And it hardly burnishes the reputation Sun has built for technological prowess and business acumen. No matter what you think of Microsoft and the company's business practices, Sun has not handled this Java dispute well.

Java will not be successful until third-party developers start making real money by using it. Sun execs acknowledge they are still seeking the killer app that makes Java indispensable to the corporate world. They won't find it in court.

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- UltraCare™ Extended Service, add \$199

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Direction Add Ons:

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- 3 Years On-Site Service (with purchase of system), add \$99



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Direction SPT233

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NOTEBOOKS

The Next Wave of Tillamooks

Intel's latest mobile Pentium processor, once code-named Tillamook, already dominates the high-end notebook market. Four more vendors—Digital, ProGen, Sharp, and WinBook—now join the Tillamook market. The Tillamook chip is smaller and cooler than the previous generation of mobile Pentium chips and requires less power.

The **HiNote VP735** from Digital Equipment Corp. (800-344-4825, www.windows.digital.com), priced at \$5,000 street, includes most every feature expected of a high-end portable. At 7.4 pounds, the unit contains a 233-MHz Tillamook processor (embedded on Intel's Mobile Module), 32MB of SDRAM

(expandable to 144MB), 512K of secondary cache, a removable 4GB hard disk, 13.3-inch XGA active matrix display, a 128-bit NeoMagic graphics subsystem with 2MB VRAM, and 16-bit stereo sound with wavetable synthesis. A modular bay in the front of this 11.9- by 9.3- by 2.1-inch machine accepts a floppy disk/20X CD-ROM Combo drive or an optional second lithium ion battery (\$219). The company plans to offer a DVD drive for this space soon.

Digital has also equipped the HiNoteVP735 with the latest in I/O, including one USB port, one Fast Infrared port, and a PC Card bay that supports CardBus and Zoomed Video. As with each of its VP700 models, the vendor gives you the option of getting either Microsoft Win-

dows 95 or Window NT (complete with power management and Plug and Play capabilities) preinstalled. Digital also bundles a copy of its DMI (Desktop Management Interface) pack-



age, ClientWORKS, making the HiNoteVP735 a leading option for the corporate market, where Windows NT has greater presence and system management is in demand. Digital's warranty provides three years of parts-and-labor coverage.

ProGen Systems (800-848-1353, www.progen.com) is offering the 233-MHz Tillamook in its **Daytona** notebook. The Daytona is the company's first laptop to use a 13.3-inch XGA display, and it is also outfitted with a 64-bit graphics accelerator (4MB SGRAM), a 20X CD-ROM drive, a 16-bit SoundBlaster Pro-compatible audio system, and a 56.6-Kbps modem. While the \$3,699 model includes 40MB of SDRAM memory and a 2.1GB hard disk, the \$4,049 model offers 64MB of SDRAM and a 3GB hard disk. A 10Base-T Ethernet card is available with the \$3,899 configuration, which uses 32MB of memory and a 3GB hard disk. ProGen ships all models with the Home Office Suite 97, Infopedia,

and a one-year parts-and-labor warranty.

The new 233-MHz Tillamook model from the Sharp Electronics Corp. (800-237-4277, www.sharp-usa.com), the **Sharp PC-9820T**, incorporates two modular bays, each of which accepts a floppy disk drive, a 14X CD-ROM drive, a lithium ion battery, or a cleverly designed internal AC Adapter that can also be used externally. The system's 13.3-inch active-matrix display uses Sharp's Super Aperture technology, which—according to the company—increases brightness yet decreases power consumption. The system will be priced at under \$5,500, and it will come with 32MB of

STEPPING OUT: 233-MHz notebooks from ProGen Systems (left) and Sharp Electronics Corp. (below).



EDO RAM (expandable to 128MB), a 3GB removable hard disk, 512K of secondary cache, and a 64-bit Trident graphics accelerator with 4MB of EDO video memory.

This machine's 12.2- by 9.65- by 2.17-inch case affords extensive I/O, including a USB port, an RJ-11 jack that connects to a 56.6-Kbps KFlex modem, Fast Infrared, Video Capture, NTSC/PAL video out, and SVGA out. With the latter three, you can

capture and edit video from a VCR or a camcorder and then play it back on an external PC monitor, an LCD projector, or a standard television. A PC Card bay, offering a Type III slot or a Type II slot, includes support for CardBus and Zoomed Video. Sharp ships each machine with an audio player, several communications applications, and a three-year parts-and-labor warranty.

Entering the 233-MHz market is WinBook Corp. (800-965-9392, www.winbook.com), with the **WinBook XL**. Priced from \$3,599 to \$3,999, the high-end model includes a 13.3-inch XGA display, while the low-end model has a 12.1-inch SVGA design. Both models use active-matrix technology.

The WinBook XL is equipped with a 233-MHz Tillamook processor, 32MB of EDO RAM (expandable to 128MB), a 4GB hard disk, 256K of secondary cache, 16-bit stereo audio, a 64-bit Chips and Technologies graphics subsystem (2MB video RAM), and a modular 20X CD-ROM drive. The latter can be used concurrently with the system's standard modular/external floppy disk drive.

Furthermore, the machine includes a PC Card bay (one Type III slot or two Type II slots) that supports Zoomed Video and CardBus, two USB ports, an NTSC video-out port, and Fast Infrared. Optional devices include a 56.6-Kbps modem (\$159), a port replicator (\$99), and a second lithium ion battery (\$199).

WinBook, the first notebook vendor to equip its machines with both touch-pad and Track Point technology, has made dual pointing devices standard with the WinBook XL (the touch pad is a \$79.99 option on the XL's sister models, the WinBook FX and the WinBook XP5). As always, these devices can be used simultaneously. No other manufacturer offers such technology.—Cade Metz

RECAP PC Magazine reviewed the first eight Tillamook systems in First Looks (October 7, 1997); the IBM ThinkPad 770 and the Micron TransPort XKE won Editors' Choice. TrendsPCs looked at three more Tillamook notebooks in the issue of October 21, 1997.

CREATIVITY

The Designer Within

No longer do you have to buy a separate software package for each of your creative tasks. Two of the leading all-encompassing creativity packages offer more functionality and features than ever before. They'll help you make holidays and events even more fun, economical, and personalized.

Sierra On-Line (800-757-7707, www.sierra.com) expands on its popular PrintArtist software with **PrintArtist 4.0 Platinum** (\$50 street). Packing over 32,000 full-color graphics, 2,500 layouts, 300 typestyles, and thousands of text effects and projects, the latest version of Print Artist includes more options than ever before.

Although clearly aimed at the home, Print Artist is versatile enough to fulfill the needs of small businesses as well. For example, you can use the software to create all the personalized matching items you need for your business, running the gamut

from letterhead and business cards to calendars, signs, and labels. At home, you can use Print Artist to create greeting cards, banners, certificates, gift bags, party hats, baskets, and boxes. You can also send a card via e-mail with the Electronic Card Maker.

As a bonus, Print Artist now includes two imaging tools: ULead Software's image editor iPhoto Express and MetaCreations' Kai's Power Goo SE, the ever-fun software that lets you distort photos in humorous ways.

iPhoto Express provides you with a selection of 16 special effects that you can apply to photos, making it easy for you to change a picture's color balance,

size, positioning, brightness, or contrast; it will even allow you to remove red-eye. Meanwhile, with Power Goo, you can create "liquid images" by taking any photo or graphic and applying smearing, stretching, shrinking, and smudging effects.

Broderbund Software (800-521-6263, www.printshop.com) is offering **The Print Shop Premier**

CREATIVITY: Play with headlines in *The Print Shop Premier Edition* (left); create cards and more with *PrintArtist 4.0 Platinum* (below).

Edition 5.0 (\$50 street). With an eye toward fulfilling the many and varied needs of home users, PrintShop has a host of activities to choose from. You can do everything from customizing cards, banners, signs, menus, invitations, and name tags to creating newsletters, pamphlets, calendars, stationery, note cards, and more.

The Print Shop Premier Edition gives you additional flexibility thanks to the 1,000 layout designs and over 23,000 graphics and photos that are included. Additional graphics and designs can be downloaded from The Print Shop's Web site. There's also Twain support for scanners and digital cameras, a logo creation engine, and the ability to customize 3M's Post-it Notes. Like Print Artist, Print Shop lets you send online greetings.—Yvonne Koulouthros



CAD

Enhanced CAD Experiences

CAD software is increasingly popular, and as such, there's a greater demand for specialized CAD software.

Hitachi Software (800-447-2579, www.hitachisoft-co.com) offers **Image Map** (\$700 street), an add-on for AutoCAD that's designed for use with GIS/mapping applications.

Image Map helps you reference large amounts of image and drawing data without draining system resources. You can build complex "key" maps by combining multiple raster file types (such as TIFF and .PCX) with existing

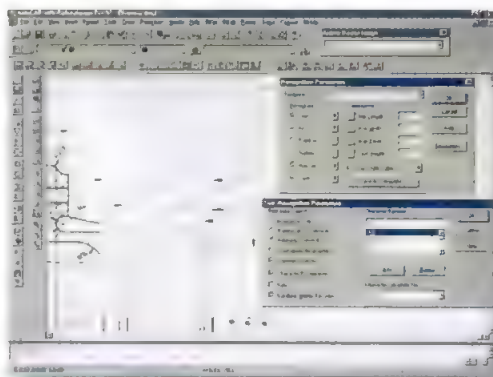


IMAGE MANIPULATION: Rasterex's RxAutoImage Pro 97 lets you edit raster image files.

legacy geopositioning files (such as .TFW, .RAT, or .RES). Then, together with these geocoded positions and predefined scales or

levels, you can zoom and pan through multiple images of differing scales and positions using standard AutoCAD commands. As you pan and adjust the zoom level,

ImageMap automatically loads and unloads images from memory based on the present viewport.

From Rasterex—and distributed by Expert Graphics (800-648-7249, www.expertg.com)—is the \$3,895 **RxAutoImage PRO 97**. This high-end add-on allows you to load and manipulate scanned image data (raster files) using AutoCAD-like commands. You can edit all or part of the image, and you can even convert the entire image into vector geometry.

Additional features in RxAutoImage include 26 options for raster entities that let you select

raster objects as they would vector and the ability to layer multiple raster files with color or grayscale images and AutoCAD drawings in one workspace. The software also comes with enhanced raster-to-vector conversion with OCR/ICR, enabling the program to recognize even arbitrarily rotated text and text partially overlapped by graphics.

DataCAD (800-394-2231, www.datacad.com) has released **DataCAD 7.50**, a 2-D/3-D architectural design and drafting program. More than just an add-on, this \$249 product includes such features as pocket and overhead door styles, new door and window controls, cavity wall cuts, multi-view windows, layer-management tools, color customization, and a change/undo function. Other enhancements include an online calculator and online documentation.—Yvonne Koulouthros

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When you need more portable power, the Micron TransPort product team charges ahead with (clockwise from bottom left): Julia, Drew, Bill, Jeff, Jeff, Andrew and Kim.



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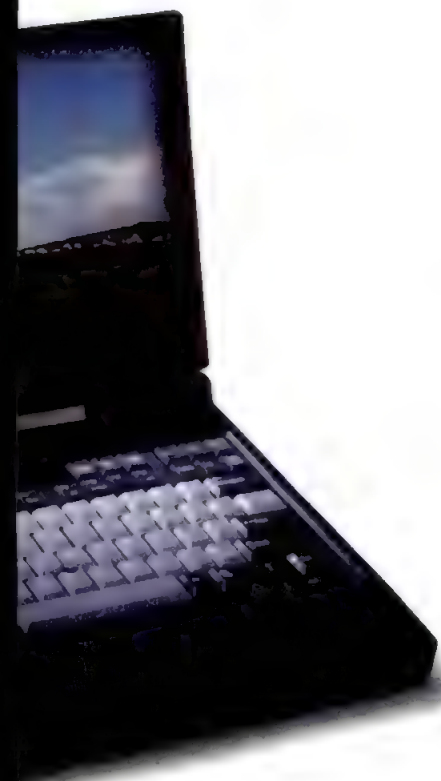
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ECC Level 2 cache on processor
32MB ECC SDRAM
2GB Ultra-Wide SCSI-3 hard drive
Microsoft® Windows NT® Server 4.0 (10-user license)
Intel LANDesk® Server Manager 2.8
NOS Support (3 incident resolutions/1st year), 7x24

STANDARD FEATURES

Single or dual Intel Pentium® II processors
512KB integrated cache in SEC package
ECC SDRAM option (4 DIMM slots)
5 expansion slots: 4 PCI, 1 ISA
Integrated Adaptec PCI Ultra Wide SCSI-3 controller
Integrated Intel EtherExpress™ Pro 100 controller
12X SCSI-2 CD-ROM drive
10 drive bays: 4 external 5.25"/1 external 3.5"
2 internal 5.25"/3 internal 3.5"
Dedicated server technical support, 7x24
5-year/3-year Micron PowerSM
limited warranty
1-year next-business-day
on-site service***

\$3,499

Bus. Lease \$119/mo.

NetFRAME MV5000

Intel 300MHz Pentium II processor
ECC Level 2 cache on processor
64MB ECC SDRAM
4GB Ultra-Wide SCSI-3 hard drive
Microsoft Windows NT Server 4.0 (10-user license)
NOS Support (3 incident resolutions/1st year), 7x24

STANDARD FEATURES

Single or dual Intel Pentium II processors
512KB integrated cache in SEC package
Memory: ECC EDO or ECC SDRAM option
9 expansion slots: 6 PCI, 2 ISA, 1 shared ISA/PCI
Dual integrated Symbios Ultra-Wide SCSI-3 controller
Integrated Symbios Narrow SCSI controllers
Embedded RAID Upgrade option
120 ready via embedded Intel i960-RD
5 Internal, hot-pluggable, hard drive array bays (Upgradable to 10)
1 (one) 360 watt hot-pluggable power supply standard
(Upgradable to 3 for added redundancy)
Rack Adapter Option
Intel LANDesk Server Manager 2.8
Dedicated server technical support, 7x24
5-year/3-year Micron Power
limited warranty
1-year next-business-day
on-site service***

\$6,199

Bus. Lease \$195/mo.

ClientPro® VXE

Intel 166MHz Pentium processor with MMX™ technology
32MB EDO RAM, support for SDRAM
1.2GB SMART EIDE hard drive
15" Micron 500Lx, .28dp (13.7" display)

512KB pipeline burst cache, flash BIOS, DMI 2.0
3Com 3C509 ISA Ethernet T-P NIC
16X EIDE variable speed CD-ROM drive
S3 ViRGE graphics accelerator, 2MB EDO RAM
Microsoft Mouse
Microsoft Windows® 95
5-year/3-year Micron Power
limited warranty

\$1,399

Bus. Lease \$48/mo.

ClientPro MRE

Intel 200MHz Pentium processor with MMX technology
64MB SDRAM
2.1GB Ultra ATA SMART EIDE hard drive
15" Micron 500Lx, .28dp (13.7" display)

512KB pipeline burst cache, flash BIOS, DMI 2.0
Pro 100 with Wake On LAN Network Adapter
16X EIDE variable speed CD-ROM drive
S3 ViRGE graphics accelerator, 2MB EDO RAM
Intel LANDesk Client Manager
Advanced hardware monitoring and power
management features
Chassis intrusion alert
Microsoft IntelliMouse
Microsoft Windows 95
5-year/3-year Micron Power
limited warranty

\$1,699

Bus. Lease \$58/mo.

ClientPro XLU

Intel 266MHz Pentium II processor with MMX technology
64MB EDO RAM
2.1GB SMART EIDE hard drive
17" Micron 700FGx, .28dp (16" display)

512KB internal L2 secondary cache, DMI support
3Com PCI 10/100 ethernet NIC
16X EIDE variable speed CD-ROM drive
PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Upgradable wavetable audio with speakers
Microsoft Intellimouse™
Microsoft Windows NT Workstation
Intel LANDesk Client Manager
5-year/3-year Micron Power
limited warranty

\$2,499

Bus. Lease \$85/mo.

***On-site service for NetFRAME LV2000 and MV5000 server is provided by Digital Equipment Corporation and is optional.

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166MHz Intel Pentium processor with MMX technology
16MB EDO RAM (40MB max.)
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Li-Ion battery
12.1" TFT SVGA, 800x600 display
256KB L2 pipeline burst cache
PCI bus with 128-bit graphics accelerator
MPEG compatible
Zoomed video-ready
Touchpad pointing device
Microphone and 16-bit stereo sound
2-way infrared port
Modular floppy drive
Microsoft Windows 95 and MS Plus!
5-year/1-year Micron limited warranty

\$2,249

Bus. Lease \$77/mo.

Micron TransPort XKE

STANDARD FEATURES

512KB pipeline burst cache
128-bit, 2MB DRAM graphics
20X modular CD-ROM drive with AutoPlay™ technology
Pick-a-Point dual pointing devices
Microphone and 16-bit stereo sound
Integrated 33.6 Kbps modem (upgradeable to 56Kbps), full duplex, CardBus- and zoomed video
2 infrared ports, S-video, NTSC, game and USB ports
Management and Executive Travel software pak
2 modular expansion bays
Dragon System NaturallySpeaking Personal voice recognition software
Custom nylon carrying case
Microsoft Windows 95 and MS Plus!
Microsoft Office 97 Small Business Edition
5-year/3-year Micron Power limited warranty

Extended VLX Notebook Service Options

2nd and 3rd year parts and labor; 3-business-day turnaround for 3 years¹ \$269

2nd and 3rd year parts and labor; 7-business-day turnaround for 3 years¹ \$209

Micron TransPort XKE 166

166MHz Mobile Intel Pentium processor with MMX technology
32MB EDO RAM
1.6GB removable hard drive
12.1" TFT SVGA display

\$3,899

Bus. Lease \$133/mo.

Micron TransPort XKE 200

200MHz Mobile Intel Pentium processor with MMX technology
48MB EDO RAM
3GB removable hard drive
13.3" TFT XGA display

\$4,899

Bus. Lease \$167/mo.

TransPort Options

Micron Executive™ desktop package: matching black 17" monitor (15.8" display), mouse, mousepad and keyboard (can be used with or without MicronDock. Available on XKE models only.) \$599

Leather carrying case upgrade \$99

Micron TransPort XKE 233

233MHz Mobile Intel Pentium processor with MMX technology
48MB EDO RAM
3GB removable hard drive
13.3" TFT XGA display

\$5,249

Bus. Lease \$165/mo.

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Performance Desktop Solutions

Millennia MME

STANDARD FEATURES

512KB pipeline burst cache, flash BIOS
Integrated 100MB Iomega Zip drive, 3.5" floppy drive
24X variable speed EIDE CD-ROM drive
32 voice wavetable stereo sound with speakers
USR Sportster 56K x2 data/fax modem*
PCI 64-bit 3D video, MPEG, 4MB EDO DRAM
Microsoft® IntelliMouse™, USB connections
Microsoft Windows® 95 and MS® Plus!
Microsoft Office 97 Small Business Edition
Choice of Micron Software Solutions Pak
5-year/3 year Micron PowerSM limited warranty

Millennia MME 166

Intel 166MHz Pentium® processor with MMX™ technology
32MB SDRAM
3.2GB Ultra ATA hard drive
15" Micron 500FGx, .28dp
(13.7" display)

\$1,599

Bus. Lease \$55/mo.

Millennia MME 200

Intel 200MHz Pentium processor with MMX technology
64MB SDRAM
4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,099

Bus. Lease \$72/mo.

Millennia MME 233

Intel 233MHz Pentium processor with MMX technology
64MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,299

Bus. Lease \$79/mo.

Micron Software Solutions Paks

Quicken Financial Pak: Quicken Deluxe, Family Lawyer, Parent's Guide to Money, Financial Planner†

EdVenture Pak: Comprised of exciting children's educational and entertainment titles. Call for current list of titles.†

Home Productivity Pak: Creative Multimedia's Family Doctor, Comptons Interactive Encyclopedia, Mindscape's Mavis Beacon Teaches Typing, Broderbund's PrintShop Ensemble III, Net Nanny, Crayola's Magic 3D Coloring Book†

Arcade Pak: X-wing vs. Tie Fighter, Need 4 Speed 2, Command and Conquer Red Alert, Thrustmaster Game Pad†

Millennia XKU

STANDARD FEATURES

82440LX chip set
512KB internal L2 cache, 2MB BIOS
Integrated 100MB Iomega Zip drive, 3.5" floppy drive
24X EIDE variable speed CD-ROM drive
32 voice wavetable stereo sound with Advent 009 speakers with subwoofer
USR Sportster 56K x2 data/fax modem*
Diamond Viper V330 128-bit 3D video with 4MB SGRAM
Microsoft IntelliMouse, USB connections
Microsoft Windows 95 and MS Plus!
Microsoft Office 97 Small Business Edition
Choice of Micron Software Solutions Pak
5-year/3 year Micron Power limited warranty

Millennia XKU 266

Intel 266MHz Pentium II processor
(features MMX technology)
64MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,599

Bus. Lease \$89/mo.

Millennia XKU 300

Intel 300MHz Pentium II processor
(features MMX technology)
128MB SDRAM
8.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$3,099

Bus. Lease \$106/mo.

Fusion 3D Option Pak

DVD-ROM, **DVD software
E4 Cool DVD PCI decoder card: 6 channel AC-3 to 2 channel out capability, SPDIF output (digital audio out)
AWE 64 ISA sound card
Cambridge SoundWorks/MicroWorks - 2 speaker satellite with subwoofer stereo system
Monster 3D graphics card with 4MB memory***
Fusion 3D game pak: Mech Warrior 2: Mercenaries D3D version, AH-64D Longbow, U.S. Navy Fighters '97, Command & Conquer, Formula 1 D3D Edition
MS Sidewinder™ Pro Joystick

MME add \$699

XKU add \$549

*Maximum transmission speed of up to 56Kbps when downloading data and 33.6Kbps when uploading. However, actual performance is dependent upon numerous factors and observed transfer rates may be less than the maximum potentials.

**The CD ROM drive will be removed upon the purchase of the DVD upgrade.

***Available only on Millennia MME system



Workstation Solutions

Powerdigm[™]

STANDARD FEATURES

12/20X variable speed SCSI CD-ROM drive
4GB Ultra-Wide SCSI-3 hard drive
Supports multiple IDE Ultra ATA and Ultra-Wide SCSI-3 hard drives
DMI, software and hardware management support
omega Jaz SCSI drive with 1GB removable cartridge
Wavetable stereo sound with speakers
Fast Ethernet 10/100 PCI network adapter
Microsoft IntelliMouse
Microsoft Windows NT Workstation
19" Hitachi SuperScan CM751 (18" display) .26dp monitor
Optional support for dual monitors
5-year/3 year Micron Power limited warranty

Powerdigm XLI

Dual Intel 200MHz Pentium II processor
64MB ECC EDO RAM
Memory upgradable to 512MB ECC EDO RAM
Number Nine Revolution 3D
video card, 4MB VRAM

\$4,899

Bus. Lease \$167/mo.

Powerdigm XSU

Samurai[™] chip set
Dual Intel 300MHz Pentium II processors
64MB ECC SDRAM
Memory upgradable to 1GB ECC SDRAM
Fire GL 1000 pro 8MB 66MHz PCI
Open GL Professional
3D accelerators

\$6,199

Bus. Lease \$195/mo.



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Felice, Brian, Fred,
Justin, Bruce
and Ron.



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5-year limited warranty on microprocessor and main memory
3-year limited parts-only system warranty (1-year for Transport 90.0)
1-, 2- or 3-year optional on-site service agreement for Micron desktop and server systems
30 days of free Micron-supplied software support for Micron desktop systems; 3 optional network operating system incident resolutions included for Micron server systems
30-day money back policy
24-hour technical support
The foregoing is subject to and qualified by Micron's standard limited warranties and terms and conditions of sale. Terms and conditions of sale may vary for specific configurations. Copies of the limited warranties may be obtained on our Web site or by calling Micron.

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A Day, 7 Days A Week
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Toll free from Canada: 800-708-1758
Toll free from Puerto Rico: 800-708-1756
International Sales: 208-893-8970
International Fax: 208-893-7393

Other Systems Options

Multimedia Options

32 voice wavetable stereo sound card ¹	\$59
32 voice wavetable stereo sound card with 2MB RAM ¹	\$99
Advent AV270 Powered Partners stereo speakers	\$79
Advent AV370 Powered Partners stereo speakers with subwoofer	\$199
Microsoft SideWinder [™] 3D Pro joystick	\$59
Microsoft SideWinder gamepad	\$39

Storage/Media Options

Adaptec 2940U Ultra SCSI Fast-20 controller	\$100
(upgrade from system with standard Ultra SCSI Fast-20 controller)	
Plextor 12/20 Plex 3MB/sec SCSI internal CD-ROM drive ¹	\$100
(upgrade from system with standard EIDE CD-ROM drive)	
omega Jaz SCSI drive with 1GB removable cartridge ¹	\$299
omega Zip IDE drive with 100MB removable cartridge	\$99
omega 6-pack of 100MB Zip cartridges	\$99
Sony 4/8GB SCSI DDS-2 tape backup drive with tape and software ¹	\$899
Cheyenne ARCserve with InocLAN	\$499

Display/Video Options

17" Hitachi SuperScan CM630 (15.9" display) .26dp color monitor ¹	\$100
19" Hitachi SuperScan CM751 (18" display) .26dp color monitor ¹	\$300
21" Hitachi SuperScan CM801 (20.0" display) .26dp color monitor ¹	\$650
Number Nine Imagine 128 series II video card, 4MB VRAM	\$299
Number Nine Imagine 128 series II video card, 8MB VRAM	\$549

Printer Options

HP Deskjet 692C	\$269
HP Deskjet 890Cxi	\$429
HP Laserjet 6Lxi	\$399
Lexmark 2030 Color Jetprinter	\$179
Lexmark 7200 Color Jetprinter	\$399
Lexmark Optra E+ Laser printer	\$399
Epson Stylus Color 600	\$269
Epson Stylus Color 800	\$399
Canon BJC - 80	\$299
Canon BJC - 250	\$149
Canon BJC - 4300	\$199
10ft. IEEE-1284 Printer Cable	\$ 16

Communication Options

33.6 external data/fax modem	\$299
56Kbps technology modem ² upgrade	\$99

Server Extended Service Options

2nd and 3rd year next-business-day ¹ on-site service coverage ¹	\$99
4-hour response ² on-site service coverage ¹ (8am - 5pm, M-F), 3 year	\$798
4-hour response ² on-site service coverage ¹ (24 hours, 7 days per week), 3 year	\$998
Other service options may be available, ask your system consultant	

Extended Desktop Service Options

Optional 1st year on-site service ² coverage included	
2nd year on-site service ² coverage	\$79
2nd and 3rd year on-site service ² coverage	\$99
Other service options may be available, ask your system consultant	

Software Options

Small Business Essentials: QuickBooks, Visio, Norton AntiVirus, Astound, Focal Point, American Yellow Pages	\$179
CorelDRAW 7 (full retail version)	\$299
Corel WebMaster Suite (full retail version)	\$99

Network Options

3Com 3C509B Etherlink III ISA combo network adapter	\$79
3Com 3C905 EtherlinkXL PCI combo network adapter	\$99
3Com OfficeConnect Hub 8/TCP	\$149
3Com OfficeConnect Switch 140	\$969

Other Options

APC Post/TT surge suppressor	\$39
APC Pro/TT surge suppressor	\$59
Microsoft Natural Keyboard (upgrade from standard keyboard)	\$49

¹ Requires SCSI host adapter
² Upgrade from system with standard Micron 17" 17FG color monitor
³ 1st year on-site service is available in the United States and in limited areas in Canada from third-party service providers per customer's agreement with provider
⁴ 2nd year and 3rd year offerings are available in the United States only. Extended services, if purchased after system shipment may have a higher cost.
⁵ Service will be scheduled whenever possible, for the next business day after parts are received by the customer
⁶ Available in certain locations, ask your system consultant for details
Some options and accessories available with system purchase only

* Maximum transmission speed of up to 56Kbps when downloading data and 33.6Kbps when uploading. However, actual performance is dependent upon numerous factors and observed transfer rates may be less than the maximum potentials.

Available only on Millennia systems with Microsoft Windows 95

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Trends Peripherals

MASS STORAGE

Take the Data and Run

Large-capacity floppy disk drives have become a necessity for many PC users. Here are some of the latest solutions in the ever-changing field of removable storage.

Market leader Iomega (801-778-1000, www.iomega.com) is now selling the new **Jaz 2GB** drive, an update of its popular Jaz solution. Priced at \$649 for the external model and \$549 for the internal model, the Jaz 2GB uses Iomega's next-generation 2GB storage media, which has twice the capacity of its predecessor. Current Jaz users can take heart in the fact that the Jaz 2GB is fully backward-compatible with Iomega's 1GB Jaz disks. The 2GB disks cost \$149 for a three-pack.

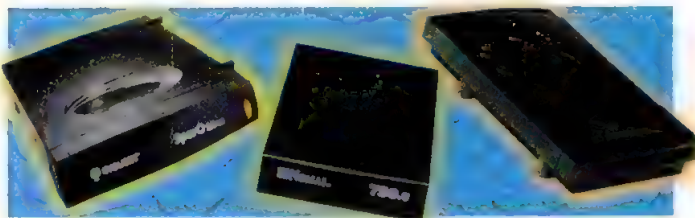
An Ultra SCSI device, the Jaz 2GB provides transfer rates that are up to 40% faster than the classic Jaz, and it has a rated service life of five years. The cross-platform device runs in DOS, Mac OS, and Microsoft Windows 3.x, Windows 95, and Windows NT. Iomega's suite of utilities includes backup, copy, and disk-maintenance tools that help you organize and protect information stored on Jaz disks.

In contrast, SyQuest (800-245-2278, www.syquest.com) has opted to forego backward-compatibility in favor of delivering the

latest and greatest technology—at a terrific price. The **SparQ** drive delivers a 1GB removable cartridge for just \$199. Currently available in internal EIDE or external parallel-port versions, a SCSI version is expected by mid-1998.

You can use the SparQ as an adjunct to your hard disk and run programs directly off the cartridge; seek times are comparable to or better than many CD-ROM drives. The drive is based on Winchester magnetic hard disk technology.

Aimed at consumers, the SparQ has a friendly interface and self-installing utilities that help ease the setup process. The drive



REMOVABLE POWER: These new cartridge drives from Iomega, SyQuest, and Nomai let you take more data than ever from home to work.

also comes with a bonus software bundle that includes games, multimedia-creation software, and a virus scanner. A three-pack of disks costs \$99.

Nomai USA (888-996-6624, www.nomai.com) has unveiled its latest drive, the **Nomai 750.c**. According to Nomai, this 750MB drive (\$300 street, external; \$250 street, internal) is as fast as the original Iomega Jaz 1GB drive and three times as

fast as the original Zip drive, which supports only 100MB disks. The 750.c comes in either a SCSI-2 internal configuration or an external parallel-port model. Cartridges cost \$70 each (street).—Josh Levy

RECAP PC Magazine reviewed 22 removable storage options in our May 6, 1997, issue. Editors' Choice winners were the Zip Drive from Iomega and SyQuest's EZFlyer 230 and SyJet.

LCD PROJECTORS

Now Showing... LCD

Last issue, our roundup of XGA LCD projectors in First Looks was missing three major players whose XGA units did not ship in time to be included in our review.

Epson America (800-463-7766, www.epson.com) adds the \$11,999 **PowerLite 7000** to its line of LCD projectors. This 14.5-pound, XGA-resolution projector produces 400 ANSI lumens

from its 150-watt metal-halide lamp.

The PowerLite 7000, which comes with a remote pointing device for use in presentations, is compatible with PAL, SECAM, and NTSC video. It also uses Spatializer 3-D sound, giving added punch to multimedia presentations.

From Mitsubishi Electronics America comes the \$11,995 **LVP-X100A** (800-843-2515, www.mitsubishi.com). An XGA-resolution projector built around a 280-watt metal-halide lamp and three polysilicon LCD panels, the projector generates 600 ANSI lumens.

A bit bulkier than the Epson, this 21-pound unit can store data for presentations onto an integrated PC card with flash memory, allowing you to use the projector without a PC attached.

There are a number of screen-customization features (such as ex-

panded zooming and gamma correction) that allow for automatic and manual adjustment of the display. The Picture-in-Picture option allows you to display data from two separate input sources simultaneously in either a split-screen or Windows-resized pairing.

Polaroid Corp. (800-816-2611, www.polaroid.com) has also brought new product to mar-

ket. Its **Polaview 315** is a new high-resolution projector that sells for \$11,995 (list). Capable of true XGA and SXGA resolutions at 24-bit color depth, the Polaview generates 600 ANSI lumens of light.

Picture-in-Picture and Double Windows make it easy to show viewers multiple screens of information either side by side or superimposed. Power focus, power-image zoom, and power-keystone correction are also included to help sharpen screen images.

If you want to give a PC-free presentation, you can use the integrated PC Card with flash memory. The machine weighs 21.5 pounds and comes with optional ceiling mounts for suspending it overhead.—JL

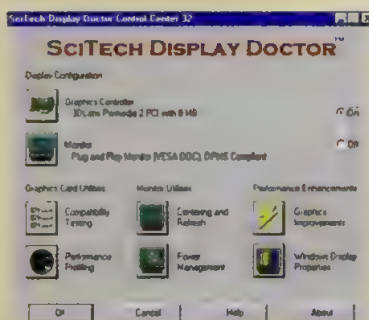


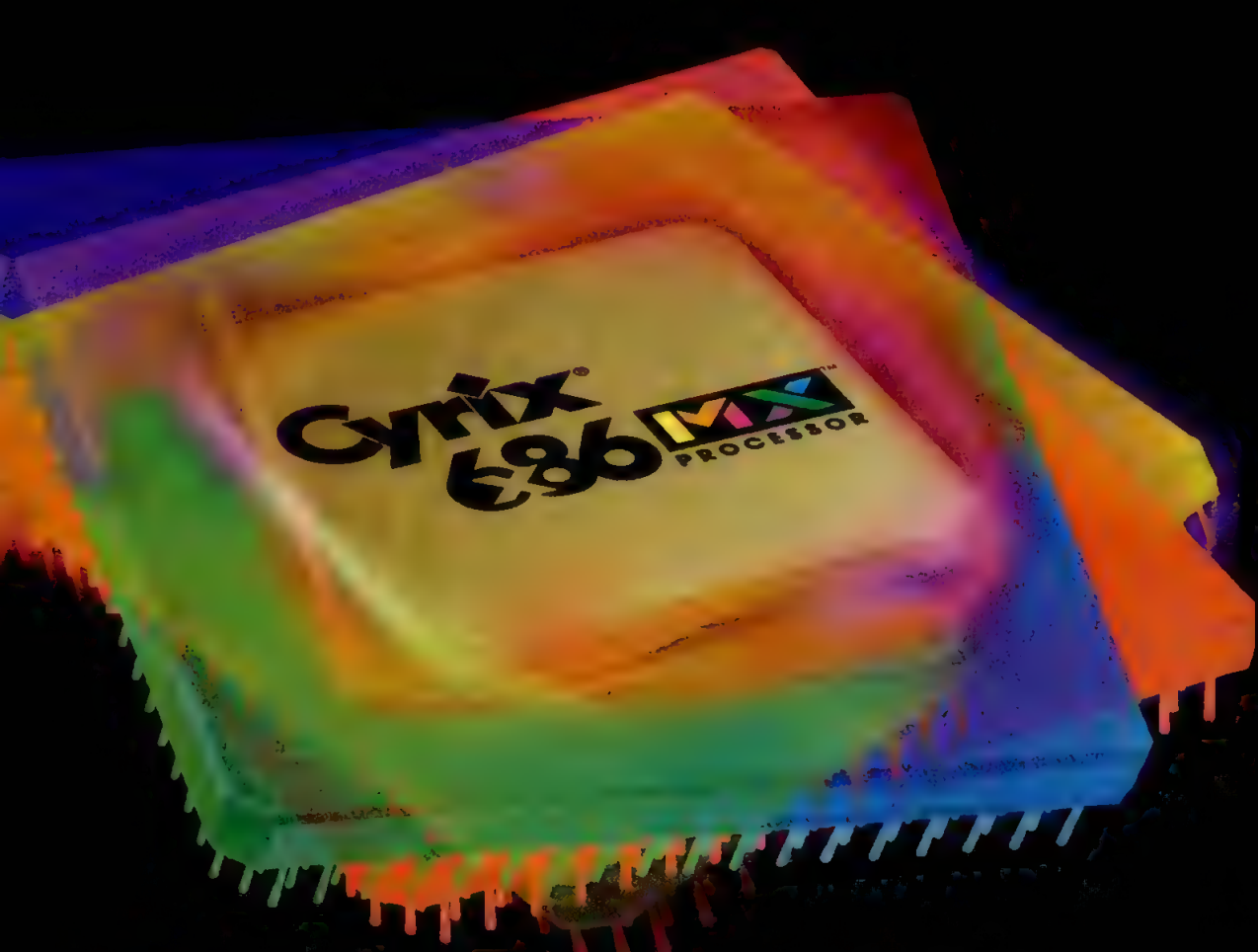
EPSON POWERLITE 7000: Crisp display, 3-D sound.

PRINTER SOFTWARE

Making the Most of Your Monitor

That beautiful display you've always dreamed of might be right in front of your eyes, thanks to Version 6 of **Display Doctor**, by SciTech Software (916-894-8400; www.scitechsoft.com). Downloadable for \$44.95, this handy utility can be used to configure your screen size, resolution, refresh rate, and color depth far beyond the ability of most graphics card drivers. It can even reduce the resolution of DOS programs for faster game play, increase refresh rate for stereoscopic viewing, and auto-detect your hardware.—JL





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6x86
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Cyrix 6x86MX™ PR200 processor	49.7
Pentium processor w/ MMX tech. 200 MHz	45.3
Cyrix 6x86MX™ PR166 processor	47.6
Pentium processor w/ MMX tech. 166 MHz	43.1

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TC Computers 800-723-8282
USA Flex 800-872-3539
Zenon 800-899-6119



Source: IDCAL, Inc. Testing Laboratories. Configuration: n-Tech R534G motherboard and SIS 5571 chipsets; Seagate Barracuda SCSI hard disk drive with Adaptec SCSI controller card; Matrox Millennium PCI graphics card with 4MB RAM; 32MB EDO RAM; 512K pipeline burst cache. All systems tested using identical configurations with one exception: the Pentium II 233 MHz processor was tested with an Intel PQ448FX motherboard and Tustin 440FX chipset. *Source: Cyrix Corporation.

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multimedia
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686 MMX[™]
PROCESSOR

MULTIMEDIA E-MAIL

Live from Your In-Box...

E-mail is a powerful tool for communicating, but basic text messages often can't convey the message you're trying to get across. Four new programs allow you to create richer content for everything from greeting cards to electronic surveys.

Broderbund's \$24.95 **The Print Shop LiveMail** (800-548-1798, www.pslivemail.com) lets you create animated multipage cards with audio to send to your friends. The program, which is included with **The Print Shop Premier Edition 5.0** (see *Trends Software* in this issue), features 200 ready-made cards,

more than 550 animations, 1,400 graphics, 200 sound clips, and a large variety of fonts, backgrounds, and borders.

After you create or choose a card, you upload it to a special Web page. The recipient gets a mail message with a link to the page, and she can play the card by accessing the site with a Java-based browser.

If you want to send a card directly into the recipient's mailbox, consider **Network Sound & Light's free CoolCards Light** or the more full-featured version, the \$24.95 **CoolCards Pro** (www.coolcards.com). Both the Light



GOIN' LIVE: Create animated e-mails with *LiveMail* (left) and *CoolCard Pro* (above).

and Pro versions create JPEG-based cards from a variety of pre-built templates. You can toggle through the alternative layouts by clicking on borders, images, and text to see your options. The Pro version gives you more control over the appearance of the card, and it supports more image types

for import. CoolCards supports a wide variety of mail programs, so you can send the card as a relatively compact attachment (25K to 75K) to anyone.

For business users, Softlink's \$39.95 **BravoMail** (415-831-9270, www.sonk.com) is a whiteboard application that can record everything that goes on inside it (including voice

annotations and animations) and send the information to other users. The recorded files can be viewed in the 300K **BravoMail Reader** (free), which can be automatically attached with the recording to an e-mail message and sent directly from the program.—Ben Z. Gottesman

PEOPLE FINDERS

Don't I Know You?

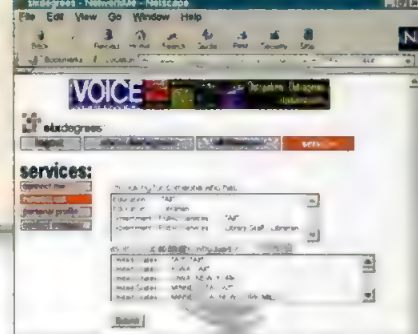
Finding people you know—or once knew—is one of the Web's more popular pastimes. Three services add a new twist to what people finders such as **Four11** and **WhoWhere?** (reviewed in "Your Complete Guide to Searching the Net") have to offer.

SixDegrees (www.sixdegrees.com) is a free networking service that's based on the theory that any-

one in the world can be linked to anyone else through six degrees of separation. Registration requires you to enter some basic information about yourself and the names of at least two people you know. These people then get an e-mail asking them to confirm the relationship and



REUNITED: *ClassMates* (left) helps you find that old high-school crowd; *Six Degrees* (below) links the world, six people at a time.



inviting them to join as well. To use **SixDegrees**, simply type in someone's name or e-mail address and the service will tell you which people you know in common. You can also search for people you're connected to who live in a specific region or have a specific occupation. Who knows? You may even end up being six degrees from Kevin Bacon yourself.

ClassMates, from **ClassMates Online** (206-630-6278, www.classmates.com), is designed to help you keep in touch with your old pals from high school. You can register and browse the **ClassMates** database for free. If you become a member (\$15 for 36 months), you can view contact information and personal bios of

other members. You'll also receive bimonthly e-mail updates with a list of registered alumni from your school.

Combining the best of both worlds is **PlanetAll** (617-661-3995, www.planetall.com), which offers the networking capabilities of **SixDegrees** combined with the reunion possibilities of **ClassMates Online**. This free service also manages your contacts, helps you keep in touch with your friends, and reminds you of important dates. As with the other sites, the more people you know who use the service, the more useful it is.—Nancy Sirapyan

CUSTOMER-SERVICE SOFTWARE

Open All Night

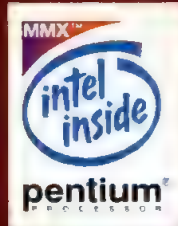
In today's ultracompetitive market, customer satisfaction is the key to maintaining a successful business. With this in mind, **Silknet Software**, a developer of customer-service solutions for the Web, has introduced **eService** (603-625-0070, www.silknet.com), a hosting service that lets businesses provide customer-service information directly over the Internet.

Customers come to your site and access the customer-service area as if you created it. They can select plain-text explanations or use full multimedia tutorials complete with streaming audio and video. Having an all-hours customer-service center on the Web helps eliminate the problems of busy signals and long wait times that often plague traditional call centers. And by using **eService**, a company will be able to free up its customer-service staff to handle only the most urgent matters.

For an example of an **eService** Web site, check out the **Pacific Bell** site (www.pacbell.com). **eService** runs on Windows NT and Unix platforms. Pricing begins at \$100,000.—William Kravitz

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3010ECX	200MHz Pentium® Processor	3.1GB HDD	64/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$4795.00
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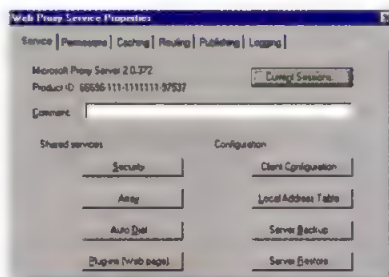
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PROXY SERVERS

The Next Level

Standalone proxy servers and firewalls are quickly becoming endangered species, and Microsoft (800-426-9400, www.microsoft.com) and Novell (800-453-1267, www.novell.com) are leading them to extinction. Both companies have released bundled proxy server and firewall solutions that combine Internet connectivity applications with security and management.

With network security a prime concern, Microsoft has added several new security features to its \$995 **Proxy Server 2.0**. The most noticeable is a three-tier firewall that supports packet filtering and circuit and application-level protection. When combined with the



ALL-IN-ONE SOLUTION: Microsoft Proxy Server 2.0.

Routing and Remote Access Service from Windows NT Server, Proxy Server can be used to create a virtual private network (VPN). The product's security features come with logging capability, and log files can be saved to an ODBC database for security analysis.

Proxy Server 2.0 has a few new tricks up its sleeve, including support for both hierarchical and array-based content caching. And

thanks to Microsoft's new Cache Array Routing Protocol (CARP), browsers can quickly find information in the array without the usual query messaging among proxy servers.

For management, Microsoft offers numerous options: the standard GUI interface, a new HTML-based interface, and a DOS interface. Adminis-

trators can use Windows NT Server's domains to set detailed user and group permission lists.

Previously released as Border Services, Novell's new **Border-Manager** (a five-user license starts at \$2,495) is a bundle of network services based on Novell Directory Services (NDS). On the security side, Novell has included a three-tier firewall to protect the network from outside attacks. It

can create multimember VPNs for site-to-site security, and it also has the ability to translate network addresses so that the entire network can appear as a single IP address from the outside.

To catch up to Windows NT's built-in remote access functionality, Novell has added remote access support for dial-up PPP for TCP/IP and IPX. Other features include PPTP support and modem pooling.

Administration for Border-Manager is completely integrated with InternetWare and NetWare's NDS structure. Network administrators can easily assign and distribute security policies from a single location. Novell also bundles Microsystems Software's CyberPatrol to prevent network users from visiting specific Web sites on company time.—*Robert Daly*

ANTIVIRUS

Group Protection

Groupware packages such as Lotus Notes and Microsoft Exchange facilitate collaboration among multiple users. But they also facilitate the exchange of computer viruses. Both DrSolomon's Software (888-377-6566, www.drsolomon.com) and Trend Micro (408-257-1500, www.trendmicro.com) address this area with new antivirus software for Lotus Notes and Microsoft Exchange.

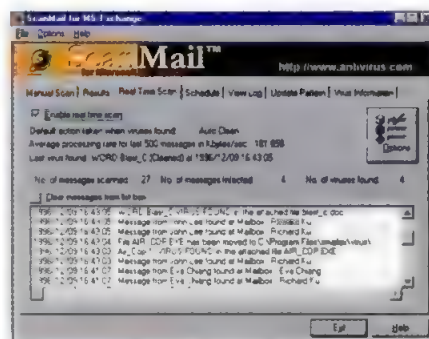
DrSolomon's anti-virus technol-

ogy in **Anti-Virus for Lotus Domino** and **Anti-Virus for Microsoft Exchange** examines all database objects for known and unknown viruses and provides a log and alert of virus occurrences. The Find-Virus antivirus engine isolates any infected file with either automatic or on-demand scanning that can be scheduled from both the user's and the network administrator's stations. The Advanced Macros Heuristic Analysis (AMHA) configurable scanning feature antici-

pates and intercepts potential macro viruses before they evolve and wreak havoc.

Both packages offer licenses for 50, 100, and 250 users, with prices starting at \$1,495. They require Windows NT 3.51 Service Pack 5 or Windows NT 4.0 Service Pack 2; Anti-Virus for Lotus uses Notes release 4.x.

All of the virus scanning for Trend Micro's **ScanMail for Lotus Notes Server** and **ScanMail for Microsoft Exchange** is done from the server where it is



NETWORK WATCH: Trend Micro's ScanMail for Microsoft Exchange.

installed. No client software is needed, eliminating installation problems at the individual workstations. Scans may be invoked manually or prescheduled and occur at viruses' principal entrance points—mail attachments, database modifications, and replicated documents.

ScanMail for Lotus Notes and Microsoft Exchange are available now. Prices for ScanMail for Lotus Notes start at \$835 for a 25-user license, and ScanMail for Microsoft Exchange starts at \$950 for 50 users. Both virus protection packages work under Windows NT, Sun Solaris, or HP-UX.—*Stephanie Lindenbaum*

SOFTWARE DISTRIBUTION

Distribute in a Flash

EPiCON (617-684-0060, www.epicon.com) has a new client-server solution for sharing software applications over the Web: **ALTIS** (pricing starts at \$2,450). ALTIS has three components—the Enabler, Administrator, and Client. They give you the ability to run applications stored at a Web site without having to download all the application files or run an installation routine. Because there's no installation, the time between starting the download and using the program is dramatically reduced.

The Enabler utility creates a file on the Web site defining the structural makeup of an application, the locations

of its components, and the Client instructions to run the application. It can then download the elements necessary to run the program into a cache on the client hard disk.

The Client is a simple browser plug-in that works with the Enabler to run applications. Simply clicking on the Web page icon representing the application will execute the software on the client system.

The Administrator resides on the Web server and defines access rules for every ALTIS application. For security, you can even give each application its own user ID and password.—*Michael N. Rusignuolo*

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First Looks



A Whole New Side to CAD

Four low-cost CAD programs go up against industry giant AutoCAD—with surprising results, proving that CAD power is now affordable.

By David Cohn

As computer-aided design (CAD) functionality has moved into the mainstream, the price of that power has plummeted. Developers of traditional CAD software have taken a page from Autodesk's playbook by offering 80 percent of AutoCAD's capabilities for 20 percent of the price. That's the same formula that worked so well for Autodesk when it first took on turnkey CAD vendors back in the mid-1980s. Indeed, the under-\$500 CAD arena is getting quite full these days. Even Autodesk is in the thick of things, with its own low-cost version of its flagship product, AutoCAD LT 97.

For many users, \$5,000 CAD programs are priced beyond reach, or they provide features well outside the scope of average drafting tasks. Although some quite serviceable drafting programs can be had for even less money, the four packages reviewed in this roundup—

Autodesk's AutoCAD LT 97, Intergraph's Imagineer Technical 2.0, International Microcomputer Software's TurboCAD v4 Professional, and SoftSource's Vdraft—are each priced under \$500, and they provide most of the 2-D CAD functions you're likely to need. Many also offer some interesting advances not yet available in more expensive applications. All four are well-suited for professional use, though some are more appropriate than others for certain tasks.

As we look at this representative sample, several interesting trends emerge. Without question, AutoCAD is the standard, and all these programs compete directly against that product. Autodesk's .DWG file format is so ubiquitous that SoftSource's Vdraft uses .DWG as its native format. All the programs can also read and write AutoCAD Release 13 files, but file integrity through a round-trip translation is questionable at best.

With the exception of Autodesk's own AutoCAD LT 97, none of the packages presently import Release 14 data. That situation will soon change, however, when Visio begins shipping IntelliCAD in the first quarter of 1998.

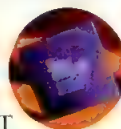
IntelliCAD was originally developed by a subsidiary of Softdesk, an AutoCAD third-party developer recently acquired by Autodesk. IntelliCAD uses R14 .DWG files as its native format. It also supports AutoLISP and ADS, two of AutoCAD's programming environments.

IntelliCAD was not available at the time of this review. Nevertheless, many traditional Autodesk developers have already announced their plans to port architectural and engineering add-ons to IntelliCAD. Also not available in time for this review is DesignCAD LT, from ViaGrafx, a replacement for the vendor's DesignCAD 2D product. DesignCAD LT should be available by the time you read this.

INSIDE

CHEAP CHIP ALTERNATIVE:

The WinChip C6 from IDT and Centaur Technology is the latest CPU to challenge the status quo. For the full review, see page 58.



MAKE A NOTE:

The new and improved Lotus Notes and Domino



Version 4.6 grow tighter with the Internet. See page 66.

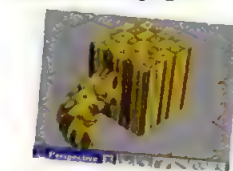
CARD COMPUTING:

The Rolodex Electronics REX PC Companion fits right into your wallet. See page 68 for the review.



TRUE 3-D:

Caligari's trueSpace 3 answers the call for new 3-D modeling and animation features. See page 73.



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First Looks

THE PLAYERS

All four programs benefit from their lineage, taking advantage of 32-bit program code and such Windows ease-of-use features as ToolTips, wizards, and Office-compatible toolbars. Most follow AutoCAD's lead, and where they diverge they offer unique features. Imagineer Technical 2.0, for example, stands out as a modern, intuitive alternative to more traditional CAD, while Vdraft shows what AutoCAD could be if it were redesigned. TurboCAD offers more customizability than the others, but it provides fewer capabilities.

Of the four, Imagineer and Vdraft match AutoCAD LT in support of Internet standards and deserve serious consideration as alternatives to AutoCAD. For overall compatibility, power, functionality, and ease-of-use—and in spite of its inability to open more than one drawing at a time—AutoCAD LT 97 clearly deserves our Editors' Choice in this roundup.

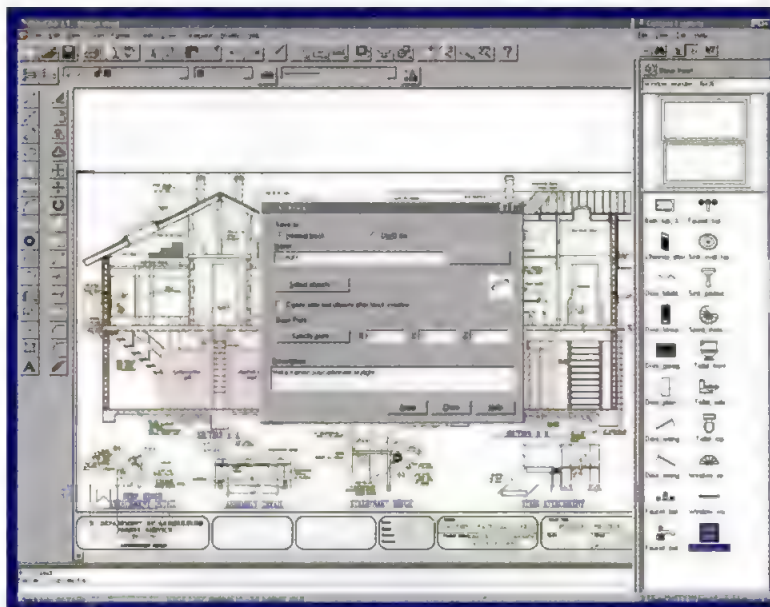
Autodesk Inc.

AutoCAD LT 97



The only program that comes close to matching the power, compatibility, and features of AutoCAD Release 14 is AutoCAD LT 97 (\$490 street), making it the hands-down Editors' Choice in this roundup. And no wonder—AutoCAD LT 97 is basically R14 without the customizability and 3-D object-creation capabilities. LT 97 even offers several new features not yet available in Autodesk's flagship product.

The most obvious changes from AutoCAD LT 95 are LT 97's complete Release 14 draw-



INFO STORAGE: AutoCAD LT 97's new Content Explorer lets you drag symbols into your drawing. The block creation dialog box works in conjunction with the Content Explorer to store block information.

ing compatibility as well as its ability to save drawings in R13 and R12 formats. The Release 14 file format gives LT 97 performance improvements such as reduced file-open and file-save times, smaller drawing file size, and transparent real-time panning and zooming in both model space and paper space.

Though the changes that most improve performance are invisible, those that improve productivity are obvious and intuitive.

AutoCAD LT 97 supports a new object snap feature called AutoSnap. You can preview and confirm snap points before actually picking a point, and you can display a Tool Tip that clearly identifies the type of geometry. LT 97 then goes a step beyond AutoCAD itself with the introduction of PolarSnap. With PolarSnap, you can snap to desired angle increments and distances relative to the previous point.

PolarSnap is a natural extension of R14's AutoSnap, but LT 97's new Content Explorer is unique and provides a new way of managing and inserting blocks and external references.

Content Explorer lets you view individual drawings in predefined or user-definable tab sets, with different types of symbols organized on their own tabbed pages. The Current Drawing tab displays all the blocks and xrefs in the current drawing. To insert a symbol as a block or xref, you simply drag the symbol from the Content Explorer into the drawing. Creating new tabs is easy, and LT 97 comes with several predefined architectural, electrical, and mechanical tab sets.

A new, easy-to-use block-creation dialog box works in conjunction with Content Explorer. You now can save descriptive text with each block and display it in the Content Explorer. As an added bonus, this feature is modeless, which means you can create multiple blocks without having to reissue the command. Content Explorer adds a new level of power to AutoCAD LT.

Like its more expensive sibling, LT 97 can now export Autodesk's Drawing Web Format

(DWF) files, create dynamic links, and launch a Web browser. HTML also plays a big part in LT 97 in the form of the new HTML-based help engine and AutoCAD LT Learning Assistance CD-ROM. There's also a Quick Tour and direct access to Autodesk's AutoCAD LT Web page.

With most of R14's capabilities; 100 percent R12, R13, and R14 .DWG compatibility; and some features not even available in Autodesk's flagship product, AutoCAD LT 97 may very well steal some

AutoCAD LT 97

Street price: \$490. Requires: 486/66 or faster CPU (Pentium recommended), 16MB RAM, 55MB hard disk space (plus 32MB disk swap space), Windows 95 or Windows NT 4.0

Autodesk Inc., San Rafael, CA, 800-228-3601, fax: 415-507-6110

www.autodesk.com/autocadlt

Circle 413 on reader service card.

sales away from AutoCAD itself. Although that may not be great for Autodesk, it makes AutoCAD LT 97 the biggest news in low-cost CAD.

Intergraph Corp. Imagineer Technical 2.0

Imagineer Technical (\$495 list) differs somewhat from the other programs in this roundup. While providing a full set of CAD tools, the program is also excellent for sketching, charting, diagramming, and redlining. Imagineer Technical provides an extremely clean and well-organized interface, with a Microsoft Office-compatible menu bar and toolbar, a draw toolbar containing most Imagineer commands, and a ribbon bar. The ribbon bar is a dynamic toolbar that displays different options depending on the current active command.

The major portion of the window is the drawing sheet, which in turn contains a sheet outline. Only entities actually placed within the outline are printed, but you can work on designs using the entire sheet and create multiple sheet outlines in each drawing. Tabs along the bottom of the screen let you switch between sheets, and you can have multiple drawings open simultaneously.

You draw objects in Imagineer by first selecting the entity type and then clicking in the drawing sheet. For precise entity creation, you can specify coordinates and dimensions in the ribbon toolbar. This can become tedious, however, because you must constantly shift focus from the drawing to the toolbar.

SmartSketch is one of several unique features that make using Imagineer quite intuitive. It provides visual feedback alongside the cursor as you draw, indicating geometry such as midpoints, intersections, and endpoints. *Intent zones* interpret your intentions as you draw and modify entities by observing how you move the cursor once you click on the mouse.

Relationships between objects give Imagineer constraint capabilities. By applying and maintaining relationships, you can modify a part of a drawing that has a relationship to another part of a drawing; the other part will then get updated automatically. For example, you can draw objects that always remain parallel, perpendicular, tangent, connected, or equal to other objects.

Many CAD programs create *associative dimensions*, whereby dimensions change when you modify the object they annotate. Imagineer also allows dimensions to drive the elements

Editors' Choice

• AutoCAD LT 97

As the four products in this roundup demonstrate, buying a CAD package that costs under \$500 no longer means you'll have to sacrifice functionality.



The standout of this group is the scaled-down sibling of the Autodesk's market-leader AutoCAD Release 14, AutoCAD LT 97 (\$495 street).

Because it's derived from AutoCAD (the missing element from AutoCAD is the ability to customize and create 3-D objects), AutoCAD LT 97 is the only program reviewed that approaches the depth and breadth of functionality found in AutoCAD Release 14. Also, it's the only package here that can support reading R14 files, which adds to the package's compatibility with AutoCAD.

With an easy-to-use interface, a powerful engine, Internet support, and a solid feature set that includes several things not even found in the full-blown version of AutoCAD, AutoCAD LT 97 will take affordable CAD to the next level.



they are applied to. For instance, after placing a driving dimension specifying the distance between two elements, you can move the elements by changing the dimension value.

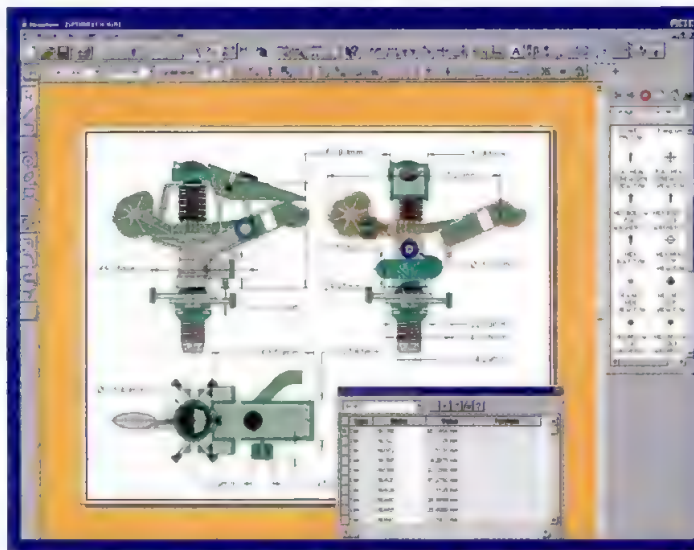
You can store a frequently

current drawing sheet.

Since Imagineer functions as both an OLE 2.0 server and a container, you can link and embed Imagineer documents within other applications. Imagineer also recognizes the

formats of other CAD programs, such as AutoCAD, enabling you to insert or embed .DWG files into Imagineer documents. Imagineer can also view any HTML document, and since Imagineer itself is also an ActiveX document, you can open an Imagineer Technical document with its own toolbars and menus in Internet Explorer.

Imagineer Technical is a powerful, state-of-the-art design program. Though not strictly a CAD package, it may prove to be more suitable for many 2-D design tasks than more conventional CAD applications.



DEFINITIONS: Imagineer Technical's embedded browser lets you drag and drop symbols. The Variable Table uses a spreadsheet to edit design data.

used drawing in one document and place it in another at any scale, position, or orientation. The Imagineer Technical Browser, embedded in Microsoft Internet Explorer 3.02, lets you drag and drop symbols into the

Imagineer Technical 2.0

List price: \$495. Requires: 486/66 or faster CPU, 16MB RAM for Windows 95 (32MB for Windows NT 4.0), 25MB hard disk space, Windows 95 or Windows NT 4.0

Intergraph Corp., Huntsville, AL 800-292-9761, 205-730-5499

www.intergraph.com/imagineer

Circle 414 on reader service card

International Microcomputer Software Inc.

TurboCAD v4 Professional

TurboCAD v4 Professional (\$300 street) is strictly a low-cost 2-D production CAD package. Although it does not aim high, it succeeds because what it does, it does well. And with an included software development kit supporting Visual Basic, C++, Delphi, and Java, it is fully customizable, extensible, and programmable. The program's Quick Tour, thorough online help, and

First Looks

printed documentation should help get you up to speed straightaway.

More than 150 tools for drawing, editing, and viewing are intuitively arranged around the TurboCAD desktop. All the tools are available from the menu and from over 25 customizable toolbars. You can also select a standard, tabbed, or flyout interface.

The tabbed interface places

all of the commands on a single, floating toolbar, leaving more of the screen available for drawing. Regardless of which method you choose, all buttons display ToolTips, and you can change the interface to suit your needs at any time.

In the program's default setup, a properties toolbar extends across the top of the drawing window while a status bar, an edit bar, and coordinate

fields extend across the bottom. All of these components can be moved, docked, or floated, and a single mouse click can restore them to their default positions.

Right-clicking while a drawing command is active displays a shortcut menu for that command. For example, when you are drawing parallel lines, the shortcut menu lets you undo the previous line segment, snap

to existing geometry, or complete the command by drawing a closing parallel line segment.

Right-clicking on an existing object displays a shortcut menu that contains modification commands. If you choose the properties dialog box from this menu, you can alter the line color, fill color, line type, layer assignment, and other object properties.

As you draw, you can specify

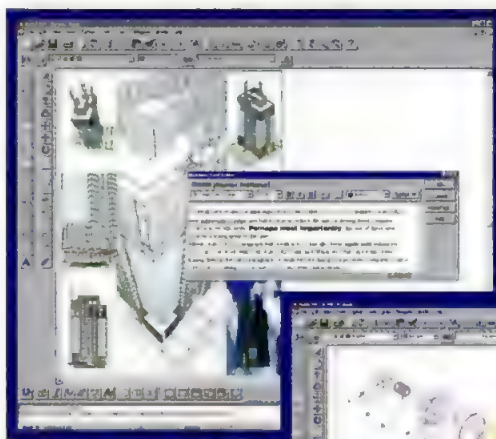
R14: Recapturing the Flag

With so many low-cost programs taking on the leader, one has to wonder whether AutoCAD itself remains the king of the CAD hill. The answer is most decidedly yes. After several shaky years under the shadow of Release 13, AutoCAD has surged back to its glory with Release 14 (\$3,750 list), dispelling any doubts about its continued market dominance through improvements in stability, performance, usability, and functionality.

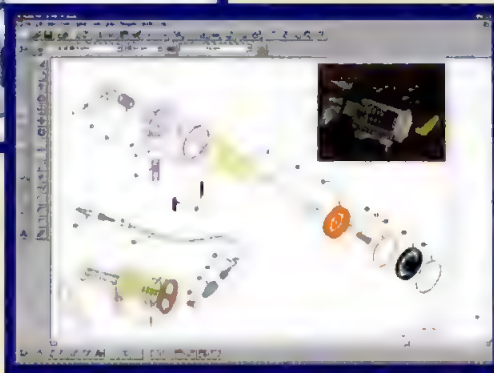
Autodesk has abandoned DOS for good, and it has also dropped Unix support in order to concentrate on the 32-bit Windows 95 and Windows NT platforms. Still, some things never change: R14 retains AutoCAD's familiar command line and even enhances it with the ability to cut and paste entries. Gone too are the annoying paper-space drawing regenerations, thanks to the program's new HEIDI-based graphics subsystem. The new graphics engine reduces AutoCAD's memory requirements by eliminating the refresh file. An added bonus is the transparent real-time panning and zooming, supported in both model space and paper space.

Performance is also improved by two other Release 14 features. AutoCAD's new lightweight polyline and hatch objects reduce file size by storing these complex objects more efficiently. Perhaps most important, the use of these new objects is transparent to the user. Upon saving an older drawing file in R14, the file size immediately decreases as the program converts polylines and hatches to the new format.

AutoCAD also handles external reference files much better



PERFORMANCE POWER: AutoCAD has improved its built-in rendering module (above) and supports displaying hybrid raster/vector composite drawings (right).



than before. The new Xclip command lets you specify a clipping window using a rectangle, polygon, or polyline. The handling of raster images is also improved and works much like xrefs. You can import a range of raster formats into your drawing, draw vector data over the raster image, apply clipping boundaries, and plot hybrid raster/vector composite drawings. A long-awaited Draworder command lets you determine which objects display on top of or behind other objects. Other new

features include AutoSnap, Solid Fill, and the Layer and Linetype Properties dialog box.

Mtext, AutoCAD's paragraph text creation tool, has been significantly enhanced so that you can now work with both AutoCAD fonts and Windows TrueType

fonts together in the same paragraph. A multi-tabbed dialog box provides complete control over text formatting.

AutoCAD's built-in rendering module has also been significantly improved. Now an ObjectARX application (to minimize memory usage), it includes photorealistic and ray-tracing renderers and enables third-party modules, such as radiosity renderers, to be added. The render module also includes an extensive materials library and landscaping objects.

Release 14 is the fastest AutoCAD ever; it even surpasses R12 DOS, the former speed champ. About the only thing missing from this latest release is the ability to open multiple drawing files. With its vast installed base, hundreds of training centers, and thousands of add-on applications, Release 14 reassures Autodesk's CAD market dominance.—DSC

AutoCAD Release 14

List price: \$3,750 (upgrade from Release 13: \$495; from Release 12 or earlier: \$695; annual subscription: \$295). Requires: Pentium/90 or faster CPU, 32MB RAM, 80MB hard disk space, Windows 95 or Windows NT 3.51 or later

Autodesk Inc., San Rafael, CA, 800-964-6432, fax: 415-507-6117

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First Looks

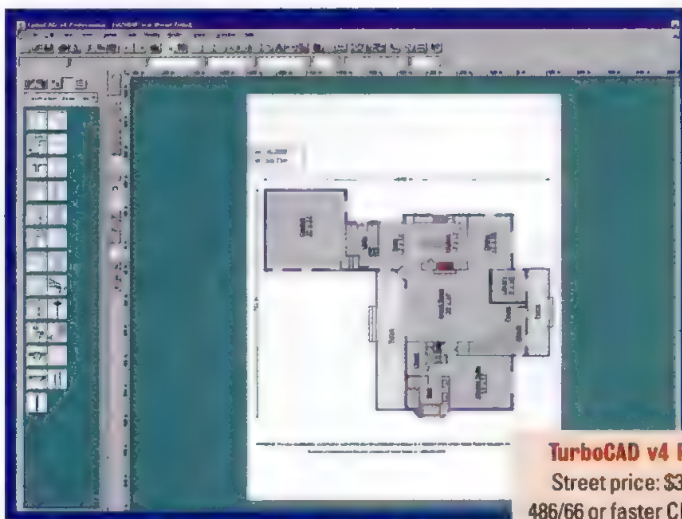
Cartesian coordinates in the coordinate fields and lock the cursor to a given length or angle by entering values in the edit bar. When you are editing, you can select commands from menus or toolbars, or you can simply use editing nodes. TurboCAD also supports local geometry snaps, but curiously enough, these do not work properly if grid snap is also enabled.

TurboCAD v4 Professional comes with an extensive library of symbols. A symbol library palette, which is similar to AutoCAD LT's Content Explorer, displays all of the drawings in a particular folder. For example, the Bath folder contains 20 bathroom fixtures. You can drag symbols from the palette into the drawing, or you can add symbols to the library by dragging them from the drawing and dropping them into the palette.

TurboCAD reads and writes AutoCAD R13 drawing files as well as WMF, DXF, EPS, and HPGL. Not all AutoCAD objects import cleanly, however, and the program cannot handle R14 drawings at all. TurboCAD also supports Autodesk's DWF format, but it only reads and writes Version 1.0 of these Web-enabled files.

When printing, you can adjust both the paper and drawing sheet sizes. A very useful option allows you to tile a large drawing across multiple sheets, and the program's powerful trace module can convert scanned raster images into TurboCAD vector drawings.

On the whole, TurboCAD offers just



EASY NAVIGATION: TurboCAD Professional offers a clean, intuitive interface. You can drag and drop symbols from the symbol library palette.

enough features to suit those who are looking for a simple, low-cost CAD program.

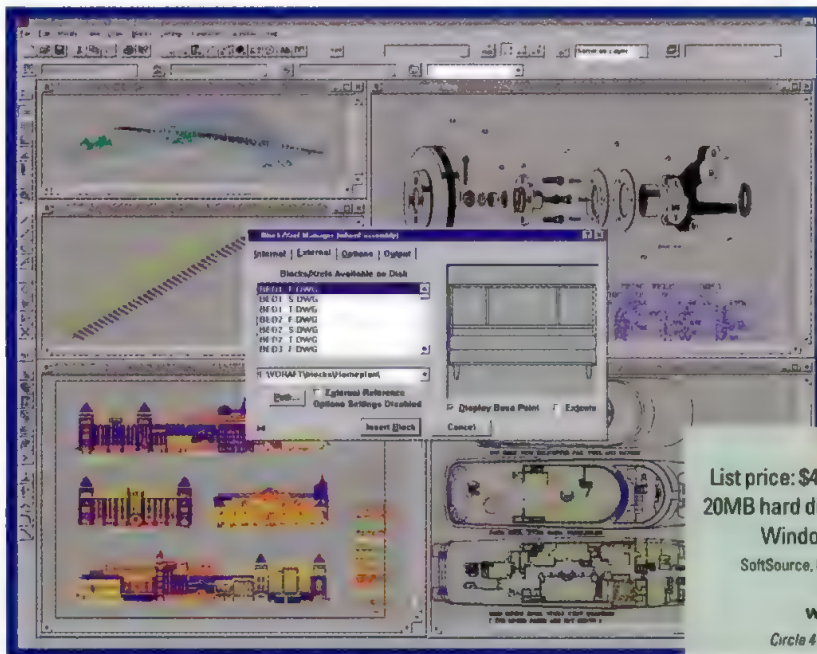
SoftSource

Vdraft

Vdraft (\$495 list), from longtime AutoCAD third-party developer SoftSource, is the only non-Autodesk package here

that offers practically 100 percent AutoCAD .DWG file compatibility, thanks to its use of .DWG as its native format. The program then does AutoCAD one better by allowing users to open multiple drawings and by providing an extremely intuitive interface that behaves much like Auto-

DISPLAYS: Vdraft can open multiple AutoCAD drawings. Its Block/Xref manager displays all external references and internal blocks.



CAD (but is easier to use).

Vdraft feels comfortable as soon as it loads. Virtually all of the commands appear on its various toolbars, which can be rearranged or undocked and floated anywhere on the screen. In true AutoCAD fashion, all commands can also be selected from menus.

You won't find a command line, but you should not let that stop you. You can still type most AutoCAD commands as well as command aliases. You will need to glance at the status bar to see what Vdraft expects you to do next, but the program's cursor tips will help move this process along.

By showing prompts that guide you through commands, Vdraft improves upon Windows' ToolTips. When you draw, cursor tips provide precise, dynamic readouts such as line lengths and angles or circle radiuses. At other times, cursor tips can display information about the entity below the cursor, and when you're working with Web-enabled drawings, HyperTips display the URLs of embedded links.

Like AutoCAD, Vdraft uses the concepts of model space and paper space. You generally work full-size in model space, using paper space to compose the finished sheet for printing. The program's default

TurboCAD v4 Professional

Street price: \$300. Requires:

486/66 or faster CPU, 16MB RAM, 30MB hard disk space, Windows 95 or Windows NT 4.0

IMSI, San Rafael, CA; 800-833-8082,

415-257-3000

www.imsisoft.com

Circle 415 on reader service card.

Vdraft 1.5

List price: \$495. Requires: 8MB RAM, 20MB hard disk space, Windows 95 or Windows NT 3.51 or later

SoftSource, Bellingham, WA; 800-877-1875, 360-676-0999

www.vdraft.com

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First Looks

templates ease the transition to this dual-mode concept by automatically creating model space viewports in a paper space drawing sheet.

Because Vdraft uses AutoCAD drawing files, it also matches most of AutoCAD's commands and features, thus supporting an unlimited number of named layers. Vdraft also uses the same line type, text font, and hatch pattern files as AutoCAD.

AutoCAD compatibility,

however, ends with Release 12, the version of .DWG that Vdraft uses. This means that you cannot lock layers or use TrueType fonts. The program also fails to match AutoCAD's robust 3-D capabilities, although you can extrude 2-D objects and specify x,y,z-coordinates when you are drawing lines and polylines.

Vdraft is also limited in other areas. It cannot read R13 or R14 drawing files, it uses a digitizer only as a relative

pointing device, and it does not support AutoCAD's AutoLISP, .ADS, or .ASE programming extensions. Vdraft does provide programming capabilities using scripts, ActiveX, and its own API.

In other areas, Vdraft goes well beyond AutoCAD, most notably in support for the Web. SoftSource's .DWG/.DXF plug-in lets you view AutoCAD drawing files as well as cut and paste over the Web. And you can save files in Simple Vector

Format (SVF), which allows hyperlinked information or text-based annotations in Web-enabled files. Vdraft also matches LT 97's new Polar Snap capabilities, and its Block/Xref Manager behaves much like LT 97's new Content Explorer.

Excellent online and printed documentation should get any user up to speed in no time. Unless the lack of R13 and 14 file support is a major issue, Vdraft deserves some serious consideration. **PC**

AUTHORING TOOLS

Breaking the Code

mBED Interactor 1.1 makes adding Dynamic HTML elements to your Web pages a breeze.

By Luisa Simone

If you don't want to stare at a screen full of code (but you still want the added interactive elements that Dynamic HTML can provide), mBED Interactor 1.1 may be your answer. A low-cost (\$249 list) authoring tool, mBED Interactor allows nonprogrammers to add multimedia elements to their Web pages.

Instead of grappling with JavaScript, you build an mbedlet (the interactive application that is ultimately embedded into an HTML document) by using object-oriented code modules called players. Like a traditional multimedia authoring program, mBED allows you to set attributes for each player object. Attributes can include data or the actual content, such as text, .GIF, or JPEG images and .WAV or Real Audio sound files; properties or formatting, such as the location of a picture, the color of text, or the volume of a sound; and handlers, which control how an object responds to specific events.

The program earns high marks for an interface that shields authors from the underlying programming code.

Players are created by clicking icons on a toolbar, edited in easy-to-understand dialog boxes, and assembled in the graphical layout window. In addition, both the Score Player and the Handler dialog box employ predefined lists of behaviors made accessible via a pop-up menu. It is quite easy to sequence the events in your application or to link a trigger

For example, the Button player is able to display different bitmaps when the user moves the mouse over or clicks on a control. And creating an animation is as straightforward as importing a series of images into the Sprite player or using the Path player to move an element across the screen.

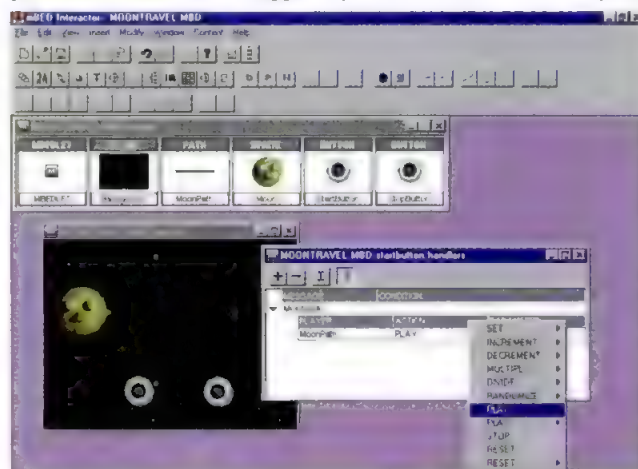
At output time, mBED automatically generates two versions of your applet in order to guarantee compatibility with Microsoft Internet Explorer's and Netscape Communicator's slightly different implementations of DHTML. Alternately, you can choose to deliver your

livery methods gives you access to features that are not currently supported by DHTML, such as anti-aliased text, alpha-channel transparency, and the ability to resize objects at runtime.

Though mBED Interactor provides a static list of object-level dependencies as a debugging tool, it leaves the larger issue of Web site management to full-featured HTML authoring programs. During testing, we discovered screen redraw problems with Matrox graphics cards and a minor bug that generates invalid path names for IE 4 (this was fixed in Version 1.1.1, which will be available for downloading from mBED's Web site on December 1.). We'd also like to see enhancements to several of the tools, such as the ability to choose colors from a Web-safe palette, editable free-form animation paths, and support for streaming video formats.

Given its low price and relatively flat learning curve, mBED Interactor has the potential to make HTML development both dynamic and accessible for a wide variety of Web authors.

mBED Interactor 1.1. List price: \$249. Requires: 486DX or faster processor, 256color display, 10MB RAM, 10MB disk space, optional sound card. mBED Software, San Francisco, CA; 415-778-0930, 888-778-6232, www.mbed.com.



PLAYER MAKER: A point-and-click interface allows you to create, edit, and assemble mBED Interactor players.

(like a mouse click) to a response (like a command to play an audio file).

Specialized players provide fast and sophisticated effects.

creation as a Java or a proprietary mBED application (which requires a Netscape plug-in or ActiveX control). Choosing these alternative de-

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First Looks

MICROPROCESSORS

The New Chip in Town

Centaur Technology and Integrated Device Technology bring a new x86-class processor to the sub-\$1,500 market.

By Patrick Norton

Reactions were mixed earlier this year when newcomer Centaur Technology, a subsidiary of Integrated Device Technology (IDT), announced at a PC Tech forum that it would drop its hat into the x86 microprocessor arena. Reactions were mostly skeptical, which is no surprise given how AMD and Cyrix have fared in the past two years in their own attempts to gain market share from Intel.

To its credit, Centaur has chosen to take a significantly different approach for the IDT WinChip C6, both in processor design and marketing. The part will be Socket 7-compatible, but Centaur has decided to target the low-cost x86 MMX-compatible part at sub-\$1,500 PCs. Leaving the manufacturing and sales to IDT, Centaur functions as a sort of in-house design boutique that tailors to the capabilities of IDT's fabs.

The relationship shows promise. Centaur's first design taped out just 11 months after the group started the design process—a phenomenally fast turnaround. Better yet, the first round of processors booted

DOS and Microsoft Windows.

More important, the C6 delivers competitive performance at a great price. The 200-MHz C6 costs \$135 in lots of 1,000 compared with the same speed Intel Pentium MMX part's current price of \$252.

The C6 also has potential for the sub-\$2,000 mobile PC market. Centaur's 3.3V 180-MHz CPU draws a scant 8 watts, which is lower than Intel's 166-MHz Mobile P55. The WinChip does not fare as well when compared with Intel's new 200-MHz mobile part (code-named Tillamook), which draws only 3.9 watts; the 3.52V 200-MHz C6 draws 10.6 watts. Still, that's about 30 percent less power than any other processor delivering the same performance (at about one-quarter the cost of the 200-MHz Tillamook).

SCALAR DESIGN

All of these features—low cost, high performance, and low power consumption—result from Centaur Technology's decision to keep the WinChip processor's design fairly simple. Though Centaur included MMX support in the design,

the C6 skips the super-scalar pipelines of the Pentium and the out-of-order execution found in the K6. Similar to a 486 processor, the C6 issues one instruction at a time and lacks any branch prediction. Combined with large on-board 32K data and instruction caches, simple control logic, and a minimal number of logic transistors, the processor is optimized for widely used instructions.

The simplicity of its design should make the WinChip C6 fairly quick to run through compatibility tests, compared to CPUs that employ out-of-order execution or super-scalar pipelines. This will allow IDT to rev the chip very quickly; the company expects to ship 225- and 240-MHz parts by the end of this year.

Despite the fact that it is manufactured on a 0.35-micron, four-layer-metal CMOS process, the 5.4-million transistor device is only 88 square millimeters in size. That's about half the size of a comparable Pentium processor. It also allows IDT to deliver a considerably larger number of processors per wafer of silicon, which cuts its costs con-

siderably. IDT plans on moving to a 0.25-micron process early in 1998.

PERFORMANCE

Though its performance will vary based on how "CPU-centric" an application is, the C6 did not suffer for its design on our Winstone test. We tested an early C6 installed on an AES system with 32MB RAM, a Diamond Stealth 3D 2000 graphics accelerator, and a Western Digital Caviar 21600

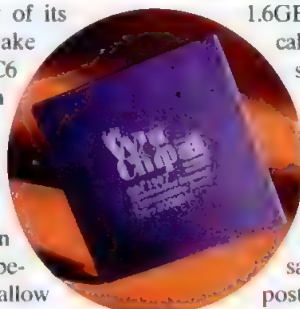
1.6GB hard disk—typical components for a sub-\$1,500 PC.

On our Business Winstone 98 benchmark tests, the 200-MHz C6's scores were nearly the same as the scores posted by the identical machine with a same-speed Pentium MMX installed (we simply swapped the chips for testing purposes). The C6 does not fare as well

on MMX tests, however (which Centaur openly admits; the vendor designed the CPU for Winstone-like business applications). On our Photoshop 4.0 tests, the AES system configured with a Pentium CPU outperformed the C6 configuration by as much as 40 percent.

Early buyers (including PC manufacturers AES and PC Club and processor upgrade manufacturer Evergreen) have the means to undercut their competition without skimping on performance. Up in the cheap seats, this might make all the difference in wresting away consumers from insisting upon "Intel Inside."

200-MHz IDT WinChip C6. List price: \$135. Requires: Socket 7 motherboard, x86-compatible operating system. Integrated Device Technology, Santa Clara, CA; 800-946-2447, 408-727-6116. www.winchip.com. Circle 412 on reader service card.

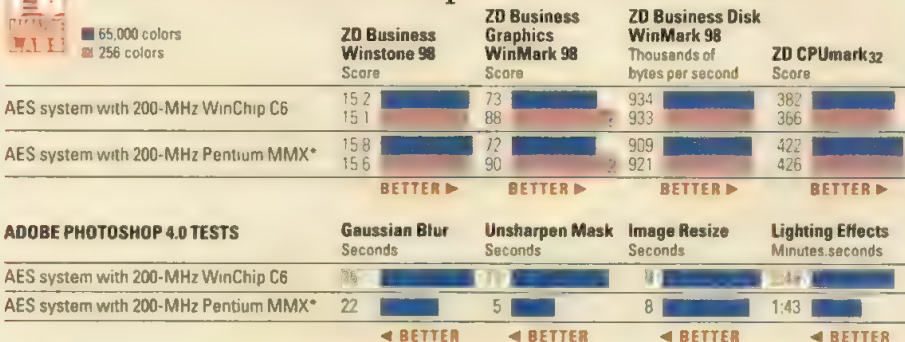


IT'S AFFORDABLE: The 200-MHz IDT WinChip C6 is a good solution for low-cost PCs.

BENCHMARK TESTS



200-MHz WinChip vs. Pentium MMX



We ran the ZD benchmark tests at 1,024-by-768 resolution using 32MB of RAM. We ran the Photoshop tests at 800-by-600 resolution with 24-bit color using 128MB of RAM (to avoid any disk activity). * Reported for comparison



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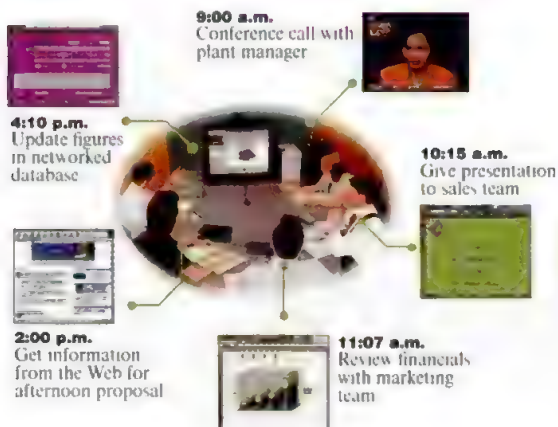
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Video Graphics	S3 Trio V2/GX	S3 ViRGE/GX	Matrox Millennium II (AGP)
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Expansion Slots/Drive Bays	5/5 Desktop	5/4 Desktop	5/4 Desktop
Ports: Serial/Parallel/USB	1/1 ECP/2	2/1 ECP/2	2/1 ECP/2
Intelligent Manageability	Yes	Yes	Yes
CD-ROM	Optional	Optional	24X with Sound
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First Looks

UTILITIES

Managing Your .ZIPs

Five utilities let you manipulate your .ZIP files with ease.

By Barry Simon

The .ZIP file format has weathered the transition from a BBS world to the age of the Internet. Tight compression and the ability to group together collections of related files make .ZIP managers ideal for a variety of tasks. You can easily deliver files or software over the Internet, organize daily backups to a removable-media device, keep abeyant files accessible on your hard disk, and squeeze files onto a disk or into e-mail.

For this roundup, we looked at five programs intended to manage .ZIP files under Microsoft Windows 95: Canyon Software's Drag and Zip, Software Builder's NetZIP, PKWare's PKZip for Windows, Pacific Gold Coast's TurboZIP, and Mijenix's ZipMagic. (For a recent review of Nico Mak Software's WinZip, see Second Looks, November 18, 1997.) We tested programs that had built-in file viewers with a collection of eight graphics file types (.BMP, GIF, JPEG, .PCX, .TGA, TIFF, .WMF, and .WPG).

Some of the programs we tested have more advanced features than just the ability to extract compressed files and add files to .ZIPs. The .ZIP specification allows some or all of the files in a .ZIP to be password-protected. This specification also allows a .ZIP file that's too big for a single disk to be placed on multiple disks, a feature that has only recently been widely supported.

If you are sending a .ZIP file to someone who may not have an unzip utility, it's important for you to be able to pack the .ZIP into an executable file. And if you download such a self-extractor from the Web, you may want to have a look inside be-

fore running it. All the programs reviewed here can make and open self-extracting .ZIPs.

Another useful feature allows you to open a .ZIP with a setup program and have the .ZIP manager unzip the files to a temporary directory, run the install, and then clean up the temporary directory—all with a single command. Both Drag and Zip and ZipMagic have this step-saving feature.

DRAG AND ZIP

The \$30 shareware Drag and Zip has separate modules to create .ZIPs and to view or manage them. It also comes with virus-scanning software from Stiller Research that scans files you extract or compress.

The separate .ZIP module allows you to specify all the files you want to zip. It can then zip as a batch operation instead of the file-by-file mode common in the other products. Nevertheless, the sizes of the files you want to compress are not displayed, so you may have trouble using single-disk .ZIPs. Drag and Zip's internal viewer could view only three of our test files.

The main ZipView module works much the same way as Windows Explorer and has support for many of Explorer's extensions. For example, when you right-click on a file, the Send To submenu supports the PowerToys extensions. Drag and Zip lets you set up predefined .ZIP sets, an ideal tool for backing up to .ZIPs placed on a removable medium.

Drag and Zip, Version 2.21. Direct price: \$30 shareware. Requires: Microsoft Windows 95 or Windows NT 4.0. Canyon Software, San Rafael, CA; 800-280-3691, 415-453-9779; www.canyonsw.com. Circle 402 on reader service card.

NETZIP

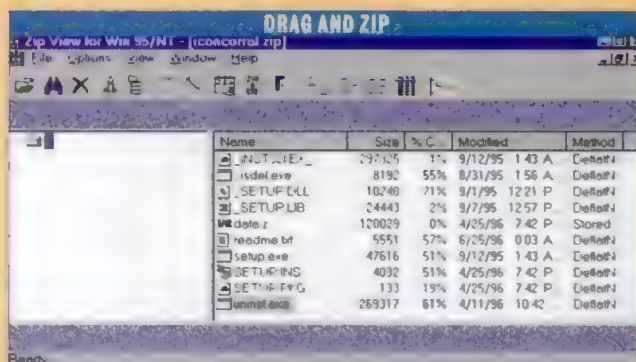
As its name implies, Software Builders' \$29.99 NetZIP offers users special Internet features. It provides a plug-in that works with Netscape Navigator and Internet Explorer to let you manage files from within the browser.

In most cases, the plug-in displays information about the file only after you have already downloaded an entire .ZIP. But if the site you are accessing has Software Builders' NetZIP Server, you can view the .ZIP directory without downloading

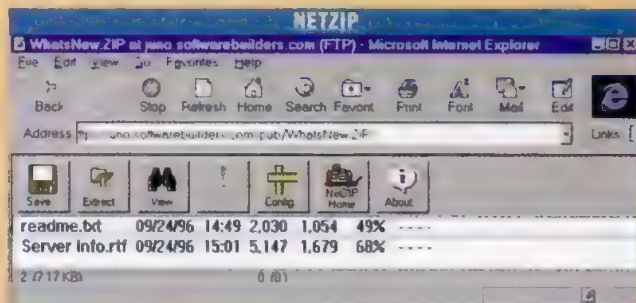
the entire file. You can also choose to download only a single file from the .ZIP.

Unfortunately, the only Web site that had this server at the time of our test was Software Builders' own site. It would be wonderful if there were an Internet standard that allowed downloading of the directory only, but we doubt that this product has the clout to produce such a standard.

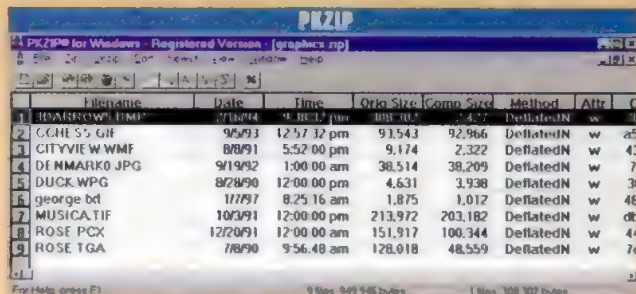
NetZIP's standalone .ZIP manager has a somewhat dated interface that would benefit from the use of Microsoft Win-



EXPLORE: Drag and Zip's ZipView module gives an Explorer-like view of a .ZIP file with a multifunction toolbar.



BROWSE: The NetZip plug-in works with both Netscape Navigator and Microsoft Internet Explorer.



EXCEL: PKZip's spreadsheet-like view of a Zip directory.

dows 95's common control. Its built-in viewer supported half of the graphics types we tested. It doesn't link to Quickview, although you can launch a file according to its extension. You can drag a file into the .ZIP manager (but not out of it), and extraction is only possible through menu commands.

NetZIP for Windows with NetZIP Plug-In, Version 4.0. List price: \$29.99. Requires: Microsoft Windows 95, Windows 3.1, or Windows NT 4.0; Software Builders, Atlanta, GA; 800-432-0025, fax: 770-540-1700;

www.softwarebuilders.com/new. **Circle 403 on reader service card.**

PKZIP

PKWare developed not only the underlying .ZIP format, but the self-extraction, password, and multidisk-spanning extensions as well. This pioneering vendor's newest version of its popular \$49 shareware program is PKZip 2.50 for Windows.

Unfortunately, PKZip's interface is ungainly. The directory display looks like a spreadsheet

rather than a file display, which would be more familiar. Instead of just clicking a column header or button, you must use the menus to sort a directory. You can drag a file into the .ZIP manager, but as with NetZIP, extraction is possible only through the menus. PKZip also lacks a built-in viewer.

This program's strongest element is the seamless way it handles multidisk .ZIPs. Instead of requiring you to specify in advance whether you'll be using multiple disks, the program shifts format automatically.

PKZip 2.50 for Windows. Direct price: \$49 shareware. Requires: Microsoft Windows 95, Windows 3.1, or Windows NT. PKWare, Brown Deer, WI; 414-354-8699, fax: 414-354-8559; www.pkware.com. **Circle 404 on reader service card.**

TURBOZIP

The \$40 shareware TurboZIP will appeal to power users who don't want to use ZipMagic's low-level system modifications. Its Explorer-like interface allows you to include several .ZIPs in the left window to help organize your files.

You can save sets of .ZIPs for automating backups, and you can even save on your hard disk a directory of .ZIP files on removable media. This will help you locate the CD or .ZIP cartridge you want.

There is an optional third pane in the .ZIP manager that will show you a highlighted file. TurboZIP's built-in file viewer was able to handle all of our test file formats except for .WPG. The viewer uses the Internet Explorer ActiveX control, so it will properly display HTML with live hyperlinks.

TurboZIP, Version 2.1. Direct price: \$39 shareware. Requires: Microsoft Windows 95 or Windows NT 4.0; Pacific Gold Coast Corp., Glen Cove, NY; 800-732-3002, 516-759-3011; www.turbozip.com. **Circle 405 on reader service card.**

ZIPMAGIC

There's a lot to like about Mijenix's \$39.95 ZipMagic. It combines the technology of the company's earlier ZipFolders with a more conventional archive manager. The program links into the file system at a low level so that .ZIP files appear as conventional Windows folders to users and the operating system. Compression and extraction are done in the background, and .ZIP files are available immediately.

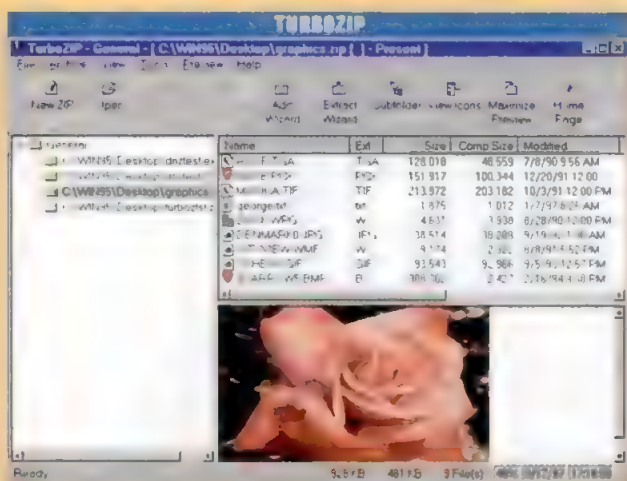
With ZipMagic, many operations with .ZIPs automatically become available to third-party programs. For example, virus scanners will look inside .ZIPs without requiring special code, and there is no need to clean up after installing from a .ZIP. Potentially, some programs may trip over this change, so ZipMagic lets you tell it whether certain programs should continue to see .ZIPs as files. It also lets you turn off this remapping at certain times of the day (when you want to back up overnight, for example).

ZipMagic's archive manager is powerful and complete. It is the only program in this roundup that was able to view all eight test graphics files. Its dual-pane view of two .ZIPs makes managing multiple .ZIPs a pleasure.

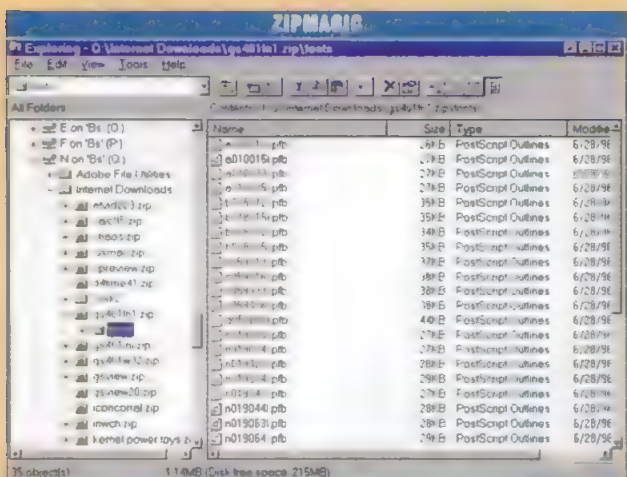
ZipMagic. List price: \$39.95. Requires: Microsoft Windows 95 or Windows 3.1. Mijenix Corp., Madison, WI; 800-645-3649, 617-277-1981; www.mijenix.com. **Circle 406 on reader service card.**

THE BOTTOM LINE

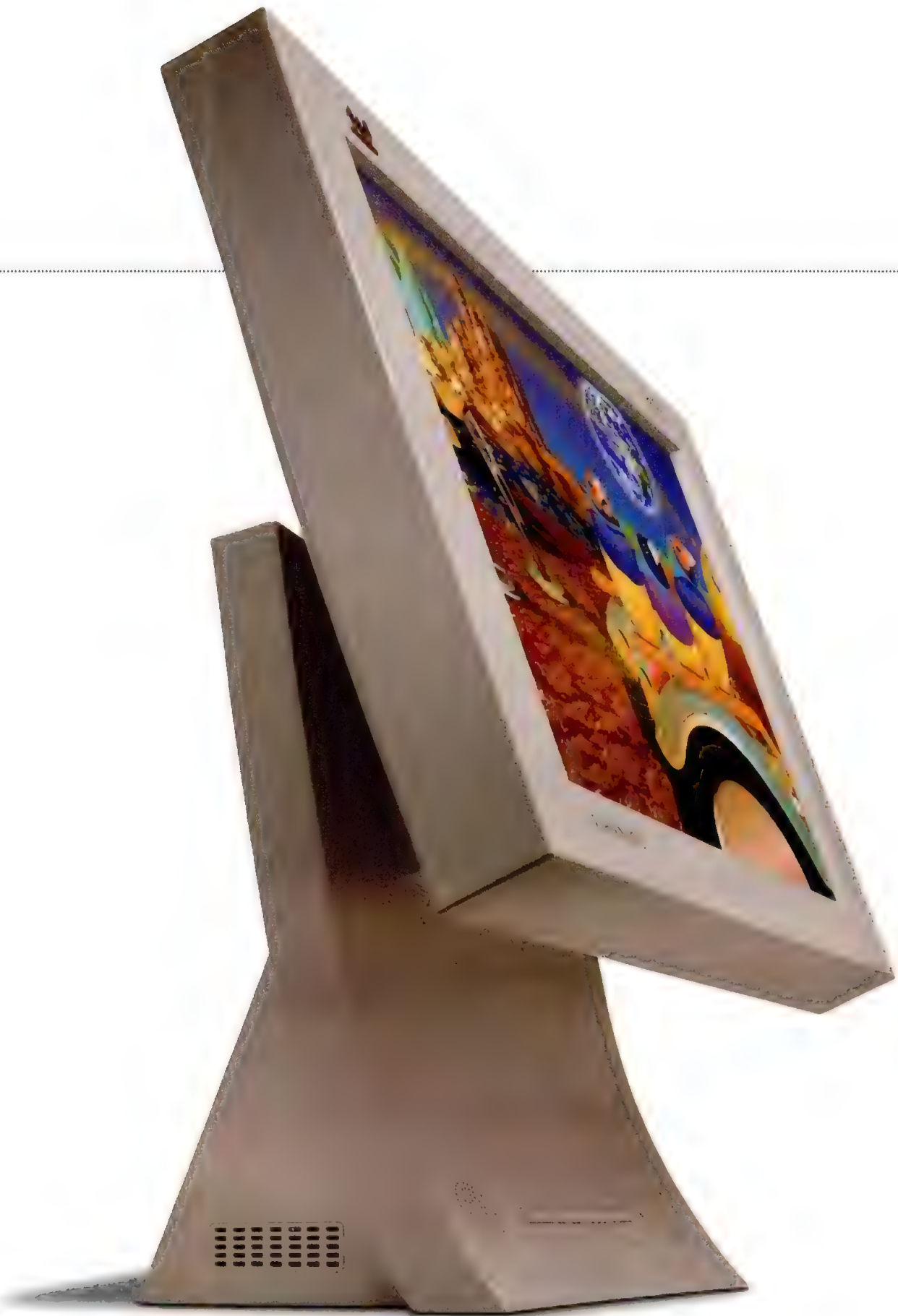
All the programs reviewed here will do basic unzipping. NetZIP and PKZip could use a little more work on their interfaces. If you're a power user, you'll love ZipMagic's seamless integration of .ZIP files into the file system, and you'll relish the functionality of its archive manager.



GET A BETTER LOOK: TurboZIP's interface will be familiar to Internet Explorer users. It also includes a view window, which will show you a preview of any highlighted file.



FILING SYSTEM: ZipMagic allows the operating system to think of .ZIP files as folders. Here, a folder within a .ZIP appears in Microsoft Windows Explorer as just another subfolder (except for the little .ZIP that's visible on the folder icon).



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Panel Type	Active Matrix TFT w/ALiGD* Technology	Active Matrix TFT w/ALiGD* Technology	Active Matrix TFT w/ALiGD* Technology	Active Matrix TFT w/ALiGD* Technology
Contrast Ratio	150:1	120:1	100:1	150:1
True Resolution	1,024 x 768 (XGA)	1,024 x 768 (XGA)	1,024 x 768 (XGA)	1,024 x 768 (XGA)
Landscape/Portrait Modes	Yes*	Landscape	Yes*	Yes*
OnView* Controls	Yes	Yes	Yes	Yes
ViewMatch* Color	Yes	Yes	Yes	Yes
Low Emissions	Yes	Yes	Yes	Yes
Built-in Audio	1.0 Watt x 2	No	1.0 Watt x 2	1.0 Watt x 2

*Utilizing supplied Perfect Portrait software. May not be compatible with all software.



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First Looks

GROUPWARE

Noting the Differences

Lotus Notes and Domino, Version 4.6, advance Internet and intranet groupware one step further.

By Tony Pompili

The new Lotus Notes and Domino, Version 4.6, push this groupware system deeper down the Internet gullet. Though predominantly Notes in look and feel, this version includes a built-in Internet POP3 mail client, better browsing, simpler Web development, and an alphabet soup of new Domino server-based Internet options.

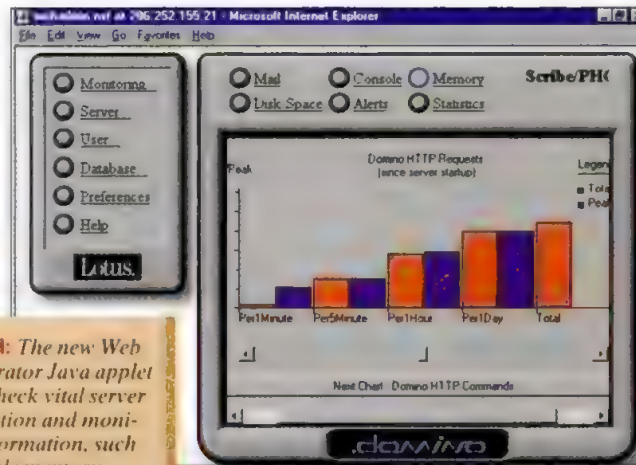
Downloadable from Lotus's Web site, Version 4.6 introduces a modest group of Internet service enhancements and PIM-related, Notes-specific improvements. This release also introduces Notes developers to a separate development client called Notes Designer 4.6 for Domino. On the back end, the Domino server now hosts almost every popular Internet service.

The most revolutionary new aspect is the independence of Notes and Domino from each other. If you configure Notes 4.6 to use the new POP3 mail instead of Notes mail, you can use Notes as your messaging client against any vanilla POP3 server. You can also use the Notes POP3 reader against a Domino POP3 server. Even if you use Notes 4.6 as your client, you do not have to upgrade your Domino servers. Lotus claims that Notes's new functionality is separate from the server.

This release is also the first to support only Windows 32-bit clients, including Windows NT and Windows 95. Lotus promises that other platforms—including Macintosh, OS/2 Warp, and Unix—will be back in sync with Version 5.0 of Notes, which is due next summer.

If there is a common thread to

the Notes 4.6 client's enhancements, it lies in Lotus's focus on integrating its Notes interface and underlying database architecture with standards-based Internet mail, newsgroups, and the Web. Notes's new implementation of POP3 in the client is a



WEB WATCH: The new Web Administrator Java applet lets you check vital server configuration and monitoring information, such as available memory.

case in point. Notes uses standard Lotus .NSF database files to store incoming mail. Mobile users can create mail off-line and then replicate or send their mail once they're connected.

Notes 4.6 options let you run both POP3 and Notes mail and allow you to store messages either in a single consolidated mail file or in separate files. You can use Notes Locations to switch between mail systems, or you can use both systems simultaneously (if you're on a Domino server with Lotus's Domino SMTP MTA). Current Notes users must upgrade to a Notes 4.6 mail template in order to receive POP3 mail.

Notes also incorporates Microsoft's Internet Explorer as an ActiveX component. When you open a Web site within Notes, the IE browser pops up in the Notes workspace and shows you the page. Similarly, Notes lets

you replace the Notes rich-text editor with either Lotus WordPro or Microsoft Word.

By attempting to consolidate multiple-user databases into a single work environment, Lotus has taken a page from Microsoft's Outlook and created Profiles. You can add multiple databases to a single workspace Profile icon. Lotus has also improved its search capability, allowing you to set up cross-database searches within your Profiles. Simple to set up and

based Java applications. You still have to develop Java outside Notes by using a third-party authoring tool such as Lotus BeanMachine for Java (which is included in the shrink-wrapped package but is not found in the downloaded version). Apart from forms, Java 1.1 applets can also be served up by the Domino server.

In addition to the HTTP and POP3 server processes introduced in Domino 4.5, you can now use Domino to host standard NNTP and IMAP4 mail servers. Also, Domino 4.6 includes an LDAP directory service process. For those starting to implement clients such as Netscape Communicator 4.0 with the LDAP directory protocol, you can now look up users and addresses in Notes's address book from your LDAP client.

For administrators on the Web, Lotus is shipping Web Admin, a new Web monitoring and configuration Java applet. Run from a Notes database, Web Admin is an interface for monitoring server information such as disk space and memory, mail-routing status, and access-control security on databases.

The Domino server has also beefed up security. It now supports Secure Socket Layer (SSL) 3.0 to provide private, encrypted data transfer and authentication as well as X.509 public/private key certification.

Notes 4.6 is still appealing, though its interface may not be intuitive or friendly to many users. But to the 12 million faithful Notes users, Version 4.6 provides alternatives for drawing Internet users and services into the Notes groupware fold.

Lotus Notes and Domino, Version 4.6. List price: Notes 4.6, \$69; Notes 4.6 Designer for Domino, \$495; Domino (single processor), \$1,495; Domino SMP, \$3,495. Lotus Development Corp., Cambridge, MA; 800-346-1305, 617-577-8500; www.lotus.com/notes. Circle 401 on reader service card.

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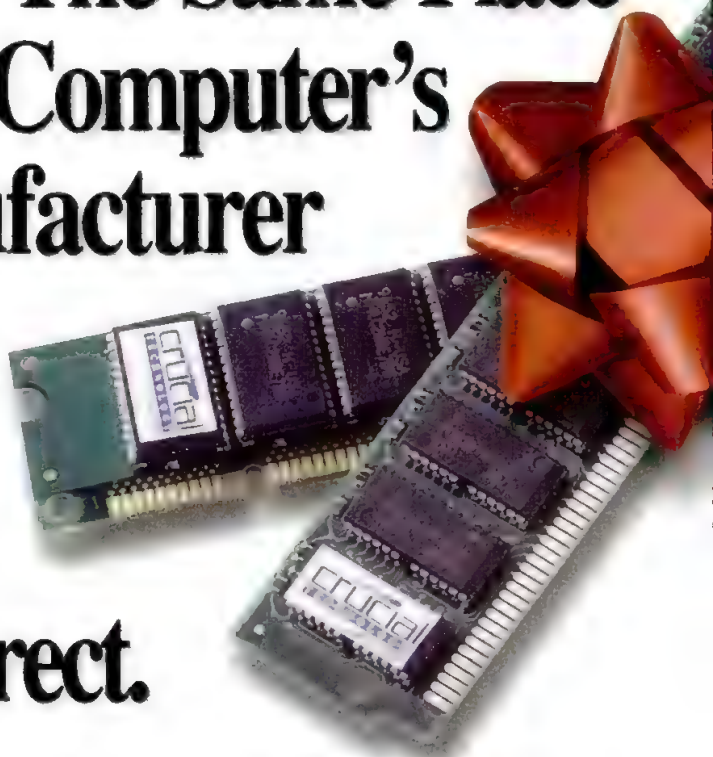
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First Looks

ORGANIZERS

Small Wonder

The new REX PC Companion takes the PIM out of your pocket—and puts it in your wallet.

By Melissa Perenson

Consider it the ultimate portable device—the kind you can tuck away in your pocket and not even notice it's there. That's how compact the Rolodex Electronics REX PC Companion from Franklin is. This PIM-for-your-pocket is both easy to use and affordable. The high-end REX-3 sells for just \$150 (street), while the unit bundled with its PC docking station costs only \$30 more.

A marvelous study in miniaturization, the REX PC Companion is the result of a tripartite partnership between Franklin Electronic Publishers, Starfish Software, and the Citizen Watch Company of Japan. The REX manages to combine the best aspects of the personal organizer

and hand-held computer with the portability afforded by a device that's no larger than a credit card, weighs 1.4 ounces, and is just a quarter-inch thick.

Housed in typical PC Card casing, the REX features a high-contrast 160-by-98 black-and-white LCD screen that's viewable in most any light. Alongside the screen is a column of five buttons to help you navigate through the REX. The device is powered by two lithium watch batteries, and it can hold up to 3,000 items. The opening screen features six icons for accessing the calendar (with daily, weekly, and monthly views), contact card files, a to-do list, notes and memos, a local and world clock, and the REX's built-in tools. But, aside from

configuring your preferences, the only means of input on the REX is checking off items on your to-do list.

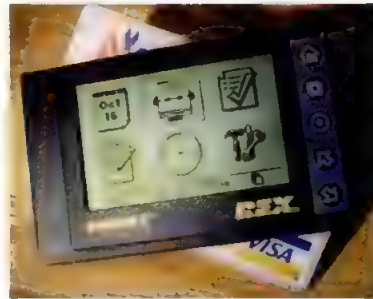
The REX offers seamless integration between hardware and software. The unit's TrueSync Information Manager software is essentially a customized version of Starfish's Sidekick PIM. TrueSync allows you to map the fields

to update only those portions you need. Once you've configured the REX, a simple click will sync the unit with your desktop's or notebook's data. And because it's a PC Card, it synchronizes with your laptop: simply plug it into the PC Card slot.

The only caveat is that on certain laptops running SystemSoft's CardWorks, you may have to disable your PC Card software in order for Windows 95 to recognize the REX. Desktop users can use the optional \$40 (street) serial-port docking station.

For viewing your appointments, contacts, and to-do list at the push of a button, the REX is the best solution available. For such a tiny organizer, the REX is clearly making a T-Rex-size impact.

REX PC Companion. Street price: \$150. Franklin Rolodex Electronics, Burlington, NJ; 888-739-6400; www.franklin.com. Circle 410 on reader service card.



PUNY PIM: The credit-card sized REX holds up to 3,000 pieces of information.

in your desktop PIM to the fields on the REX—which is useful if you're importing your data into TrueSync from another PIM—and lets you configure your REX

ORGANIZERS

Good to Go

Texas Instruments' Avigo gives PalmPilot a run for the money.

By Cade Metz

The \$300 (street) Avigo personal organizer, from Texas Instruments, serves the same niche market as US Robotics' popular hand-held organizer, the PalmPilot Professional Edition (see *PC Magazine*, April 22, 1997). Both units weigh less than 7 ounces and can fit comfortably inside a shirt pocket.

The Avigo and the PalmPilot are both loaded with all the usual PIM (personal information manager) applications, including address books, to-do lists, memo pads, event schedulers, and expense trackers. The Avigo's screen is 160 pixels high and 240 wide (the PalmPilot is a square 160-by-160). Both let you syn-

chronize data with spreadsheets and standard PIM software on your PC. The Avigo is unable to synchronize data via LANs or phone lines (as the PalmPilot can with optional add-on hardware), but the Avigo incorporates a standard infrared port for wireless file transfers.

Unlike the PalmPilot, the Avigo lacks handwriting-recognition software and an on-screen writing pad. You can use the Avigo's sketch program to draw bitmap images, but all character-based data must be inputted through an on-screen

keyboard or your PC. One of the Avigo's two keyboards is equipped with Tegic Communications' T9 technology. T9 os-

tensibly increases typing speeds by reducing the number of character keys. A single key houses three letters, so as you type, Avigo attempts to guess the word you're entering. This technology takes some getting used to, but it can speed up data entry (if only slightly).

Transferring data from the unit to a PC is done by either a serial or an infrared connection. A small docking station, much like the one that ships with the PalmPilot, connects the unit to your PC's serial port. Texas Instruments bundles the unit with Lotus Organizer

(which imports sketches and spreadsheets).

Measuring 5.50 by 3.25 by 0.75 inches (HWD) and weighing 7 ounces, the Avigo is only slightly larger than the PalmPilot and is only 1.3 ounces heavier. Like the PalmPilot Professional, it uses two AAA batteries and has 1MB of memory. The main difference between the two units is price: The Avigo is about \$100 less than PalmPilot Professional Edition.

Over the past year, the PalmPilot has gained a healthy reputation in the marketplace and a healthy amount of software support from third-party vendors. The Avigo may be cheaper, but it lacks the PalmPilot's influence and industry standing.

Avigo. Street price: \$300. Requires: 486 or better CPU, 8MB RAM, 49MB hard disk, CD-ROM, serial or IrDA port, VGA or better graphics; Texas Instruments Inc., Dallas; 800-842-2737, 972-917-8324; www.ti.com/avigo. Circle 411 on reader service card.



OPEN UP: The Avigo's cover tucks behind the unit.

97, a version of Puma Technology's IntelliSync (to transfer PIM data), and a proprietary package known as the Avigo Manager



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- Sound Blaster Compatible Sound
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- Sound Blaster Compatible Sound
- 10/100 PCI Ethernet Adapter
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First Looks

GRAPHICS SOFTWARE

Create a Better 3-D World

Caligari's trueSpace 3 improves and expands its feature set for 3-D modeling and animation.

By Luisa Simone

Caligari trueSpace 2, a popular, mid-priced (\$795 list) 3-D modeling and animation program, earned some serious criticism in our last roundup of 3-D animation software (November 5, 1996). Chief among the program's shortcomings were a lack of Inverse Kinematics (IK), integrated VRML functions, sophisticated data structures such as NURBS (Non Uniform Rational B-Spline), and a robust keyframe editor.

Version 3 delivers many of these functions (and a few new ones to boot) with an interface that provides speedy visual feedback. Caligari's twist on IK, for example, includes highlighted joints that clearly indicate the

links between limbs.

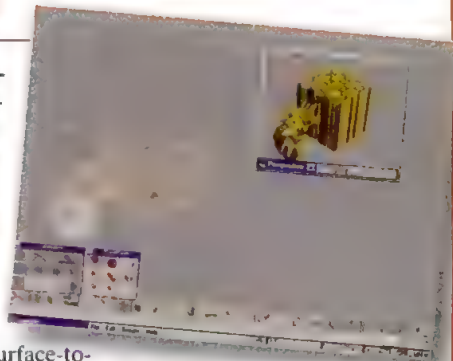
VRML support provided by Caligari's Pioneer, which has been rolled into trueSpace. This includes an integrated browser that lets you surf through 3-D worlds on the Web. A strange inconsistency limits the trueSpace browser to VRML 1.0 worlds, though both VRML 1.0 and 2.0 are supported as output options.

As a polygon-based (rather than spline-based) program, trueSpace in all likelihood will never support NURBS per se. But the new Metaball technology is ideal for modeling organic forms, because it describes objects as energy fields that can meld and stretch as they draw near or apart from one another. In addition, the new Plastiform

tool converts a polygonal surface into a particle mesh that can be deformed in the way a heat gun molds lead.

Last but not least of the new modeling functions is the Magnetic tool, which provides automatic collision detection and surface-to-surface contact between two specified objects. Even when you are working in Caligari's single-perspective view, the Magnetic tool virtually guarantees that objects will be accurately aligned.

You can create almost-automatic animations by using trueSpace's new physics features. In this mode, elements interact with one another and with the larger environment based on local properties (such as rubber or Styrofoam) and global properties (gravity or wind, for example). But regardless of the property you assign to an object, it remains rigid. And even though



SHAPELY: trueSpace's new Plastiform tool lets you easily mold or melt shapes such as a sphere (shown here) or a cylinder.

trueSpace allows you to set certain conditions that influence an animation, for accurate positioning you must ultimately—and tediously—edit the points along the motion path generated by the simulation.

Sadly, Version 3 does not contain improved animation controls. The keyframe monitor still makes complex animations difficult to edit. But Caligari does have a Version 3.1 beta patch on its Web site that adds a new keyframe editor to the program.

Like its predecessors, trueSpace 3 delivers quick response times. Caligari has supplemented the Intel 3DR display drivers with Microsoft's DirectX drivers. The program also supplies Intel's RSX drivers for 3-D sound. But we found it necessary to download the SDK versions of the drivers from Intel's Web site in order to install the drivers properly.

trueSpace 3 addresses the needs of its core user-base: game designers, multimedia producers, graphic illustrators, and Webmasters. The program introduces new data structures and new interface conventions that make 3-D modeling and animation more intuitive.

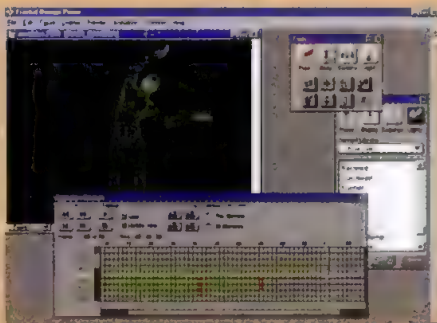
trueSpace 3. List price: \$795 (upgrade, \$299). Requires: 486/DX or better CPU, Microsoft Windows 95 or NT 4.0, 16MB RAM, 15MB hard disk space, VGA graphics adapter, CD-ROM drive. Caligari Corp., Mountain View, CA; 800-351-7620, 415-390-9600; www.caligari.com. Circle 407 on reader service card.

Strike a Pose

Representing the human form in all its diversity is now easier than ever, thanks to a new version of Poser from MetaCreations. The core functions of this 3-D modeling program (\$150 street) remain virtually unchanged. You can modify the size, shape, and position of an articulated figure in space. Customizable lights, camera angles, surface maps, and an internal ground plane help you integrate the figure into your artwork.

The improvements start with more detailed wireframes. We liked the ability to create poses using simpler (quick-response) meshes, substituting the more realistic wireframes at render time. The program's newfound ability to import and export .DXF, .OBJ, .3DS, .3DMF, and Detailer .TXT formats lets you add props to a Poser figure or use a Poser wireframe in programs such as Wavefront or 3D Studio.

Poser can now move figures through time as well as through space. Almost all bodily transformations can be animated, as can changes to light, color, light placement, camera view, and props. You can smooth the motion between poses and import .AVI (or Quicktime) movies as backgrounds to produce a figure that moves



ANIMATE: Poser highlights the current element in both keyframe and wireframe windows.

realistically through a scene.

Poser is not a full-featured 3-D modeling and animation program. It does only one thing—it moves the human figure intelligently through space. But aspiring Muybridges, whether they be illustrators or animators, will consider this an essential program for their graphics toolkits.

Poser 2. Street price: \$150. Requires: 486 or better CPU with math coprocessor, Microsoft Windows 95 or Windows NT 4.0, 16MB RAM, VGA graphics adapter, CD-ROM drive. MetaCreations Corp., Scotts Valley, CA; 800-846-0111, 408-430-4100; www.metacreations.com. Circle 408 on reader service card.

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First Looks

DEPARTMENTAL NETWORK PRINTERS

Grade A Printing

Lexmark's latest entry, the Optra S 2450, offers 24-page-per-minute printing in A-size format.

By M. David Stone

The latest printer in Lexmark's Optra S line, the Optra S 2450 (\$2,650 street), has a lot to live up to. In *PC Magazine's* most recent look at network printers (June 10, 1997), the two Optra S printers reviewed were Editors' Choices in their respective categories. The Optra S 2450 is just as impressive, but with a 24-ppm engine it fits firmly in the departmental printer category.

Unlike most departmental printers we've seen recently—including all the entries in our last roundup—the maximum-size paper for the Optra S 2450 is A-size (letter and legal) rather than tabloid size. But if you never make tabloid-size prints, there's no point in paying extra.

The base configuration of the printer (\$2,250 street) comes with 4MB of RAM and a parallel port. The version we looked at included 12MB of memory and a Fast Ethernet card. The extra RAM is enough to hold several rasterized pages. This means that the engine rarely has to stop and wait for a page to finish processing, even if there is a complex page in a print job. Lexmark claims that the additional RAM increases perfor-

mance by 20 to 40 percent.

Setup is simple enough: The printer fits over the stackable paper-feed module and automatically makes the right connections. Installing the Postscript level 2 driver and combination PCL 5 and 6 driver is also simple (the printer uses Lexmark's own Postscript emulation). The problems appear when you set up the printer to work on your network.

One of the first steps is to print the setup page from the LCD-based front-panel menu. Unfortunately, the manual does not tell you where to find the option, which is four menu levels deep. More troublesome are the Lexmark Mark Vision's instructions, which tell you to set up the printer without using NetWare's PconSOLE. The manual says to change settings on a given screen without explaining which settings you should change—or why. The details are available on CD-ROM, but it would be easier to read the hard copy. Ultimately, however, this is just a minor annoyance.

Once you've figured out how to use the MarkVision, you'll find that it offers a full array of configuration and network-management features. Not only can you configure the printer, you

can also create, manage, and configure print servers and print queues. You can even monitor the printer status by having the message that's currently showing in the printer's LCD get displayed on your screen. Even better, the LCD messages are in English, not arcane codes.

Paper handling is a strong point. The base unit comes with

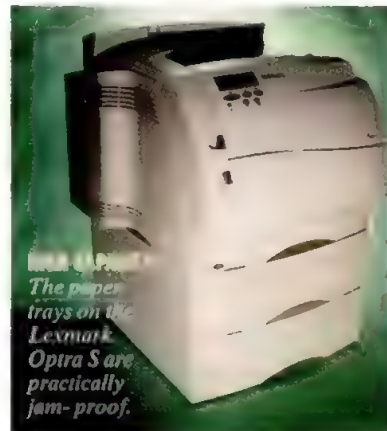
but tear the leading edge as well. Even then, it didn't always jam.

Performance is another strong point. We ran the Optra through the same suite of tests that we used in our last network printer roundup (using the same test-bed setup). Compared with the 24-page printers in that roundup, the Optra turned in the fastest time (or within 3 seconds of the fastest time) on every test.

Output quality for both text and graphics was appropriate for both the 600-dpi and 1,200-dpi modes, with edge enhancement adding a quality boost to text and line graphics. The printer offers a so-called 1,200 image quality mode, which enhances gray-scale images without slowing the printer down to 1,200-dpi speed.

The combination of features—from paper handling to network management and functionality to performance—makes this printer a clear winner by any reasonable standards.

Lexmark Optra S 2450. Street price: \$2,650. Requires: Ethernet connection, NetWare 3.x or higher, Windows 3.x, Windows 95, Windows NT 3.1 or higher, OS/2 2.1 or higher, Unix. Lexmark International Inc., Lexington, KY; 800-539-6275; 606-232-2000; www.lexmark.com. Circle 409 on reader service card.



a 250-sheet printer drawer and a stackable sheet feeder with two 500-sheet drawers. MarkVision lets you specify what kind of paper is in each drawer. The printer can automatically choose the right drawer for a print job and switch to another drawer with the same paper (should the first drawer run out of paper). There are also a variety of high-volume paper trays available.

Even more impressive is that the printer is all but jam-proof. To make the printer jam, we not only had to crumple the paper

PERFORMANCE TESTS

Network Printers



The Lexmark Optra S 2450 performed extremely well against its 24-ppm competition. Its scores matched or beat those posted by its sibling, the Lexmark Optra N 245 (an Editors' Choice in our

network printer roundup of June 10, 1997). We tested on two Micron Millennia PCs, each equipped with 16MB of RAM and running Windows 95 and Word 7.0. For more details on how we tested, see page 198 of our June 10 issue.

	50-Page Simplex		Multiple Simultaneous Jobs		Multiple Copies Of a Single Job	
	Minutes:seconds	Minutes:seconds	Effective ppm	Concurrent jobs	Minutes:seconds	Minutes:seconds
Lexmark Optra S 2450	2:15	2:41	22.4	3	3:00*	
Lexmark Optra N 245**	2:14	2:42	22.2	3	2:57*	
QMS 2425 EX**	2:45	3:11	18.8	2	3:18*	
	◀ BETTER	◀ BETTER	BETTER ▶	BETTER ▶	◀ BETTER	

* Collating was set through the printer driver, not the word processing application. ** Reported for comparison.



Source: PC Buyer's Guide, PC Magazine, June 24, 1997

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Source: PC Magazine, June 24, 1997

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High-End Winstone 87

ProGen Polaris 230 Score: 90.4

Micron Millennia Pro2 200 Plus Score: 20.1

Source: Computer Shopper, July 1997

Business Winstone 87

ProGen Polaris 230 Score: 87.1

Micron Millennia Pro2 200 Plus Score: 60.3



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Second Looks

ONLINE GUIDES

Another Walk down the Sidewalk

Sidewalk has had a complete makeover, and Microsoft's online guides to Boston, New York, Seattle, and the Twin Cities now make it easier to search their listings of restaurants, movies, events, and places to go. At www.sidewalk.com, you'll find new navigation buttons at the head and foot of each page along with new lists of pre-selected search options. A personal page lets you store listings for future reference. In addition, maps now include zoom controls. Like most Microsoft online productions, Sidewalk has become a hip graphic designer's dream come true.

Unfortunately, Sidewalk has not become much smarter. We

compared Sidewalk's New York site with that of its chief rival in the Big Apple, CitySearch—*PC Magazine's* Editors' Choice for online guides ("Think Globally, Surf Locally," August 1997). CitySearch's design is less hip than Sidewalk's, but (in virtually all categories) CitySearch knew more about New York events and places to go, made it easier to zero in by neighborhood, and had sharper and more believable reviews. Sidewalk was far ahead in some fields, but CitySearch, despite its looks, proved to be a lot more cutting-edge in its content. CitySearch's maps do not zoom in and out, but they are more detailed than Side-

walk's most detailed view.

Sidewalk's previously puzzling search engine is no better in the makeover. A search for "Episcopal Church" brought up a major Baptist church. Side-

walk sometimes gives you only the starting times and not the ending times of events like book signings; CitySearch, by

contrast, supplies you with a four-hour time frame. To see if Sidewalk's content had improved, we checked out a film review. Sidewalk longwindedly hedged its bets, while CitySearch said more about the film in one-fourth the number of words.

If you want the hippest graphic design in an online city guide, stick with Sidewalk. But if you can't decide where you want to go today, start with CitySearch.—*Edward Mendelson*



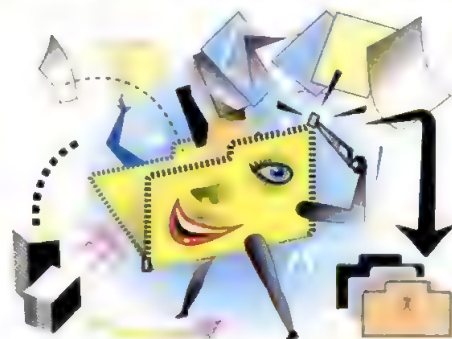
WINZIP

Perfectly Packed Files

When we last looked at Niko Mak Computing Inc.'s WinZip (Utility Guide, April 8), we thought it was an excellent program that was suitable for both the beginner as well as the power user. Recently, the company released the newest version of the program—WinZip, Version 6.3—adding several key features that make it one of the best file-compression utilities available today.

As with previous versions, Version 6.3 lets you work with Classic or Wizard WinZip interfaces. If you are not too familiar with compression software, you may want to choose the Wizard. This version will hold your hand through the entire process, from finding and opening .ZIP archives to choosing a target directory for the unzipped files. If the archive contains distribution

and setup files for a software program, WinZip will even let you perform the installation right from within the program's interface.



There are a variety of improvements in Version 6.3. Anyone who has ever run out of room on a disk or has needed to transfer files using floppy disks will love its new spanning capabilities. This feature lets you

unzip a file and split it in half as needed—even if you run out of space during the process. And unlike other programs of its kind, Version 6.3 does not need to be set up beforehand.

Another major and very welcome improvement is the program's ability to interface to the free Internet Browser Support add-on. The add-on lets you download and extract files directly from the Internet via your browser—you do not have to use the Save As command, because WinZip will do it all for you. This functionality, however, can only be accessed once you have downloaded the add-on.

WinZip will work with a number of different file types (including uuencoded, xxencoded, BinHex, and MIME files), in ad-

dition to creating and unpacking .ZIP, .TAR, and GZIP file formats. Long filenames are also supported, and you can use WinZip to create .EXE files and perform safe virus scans on unopened archives.

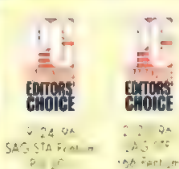
There are a number of other improvements and bug fixes in this version. Folder management has become much simpler. WinZip now automatically restores folders to their original condition after zipping or unzipping files, and there are several new right-click menus. In addition, the WinZip Wizard can handle password-protected files. Previously, only the Classic version could do this.

You can download an evaluation copy of WinZip, Version 6.3, from the Web (www.winzip.com); the program costs you \$29 if you decide to keep it.—*Karen J. Bannan*

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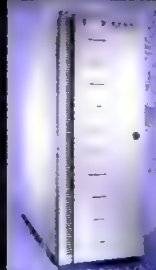
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Better Homes and Gadgets

I think I've finally discovered my role in life: to write about every weird and wonderful thing you can attach to a PC. The latest cool gadget is the Plato HouseLinc, and it lets you control lights and appliances from your PC. Such devices have been around for years,

but this one, with its internal smarts and slick software, brings setup and use to new heights of simplicity. At the same time, it gives you capabilities, such as controlling your TV and stereo, that previously required multiple units.

The Plato HouseLinc uses standard X-10 codes to control lights and appliances and has infrared transmitters and receivers for your audio-visual or home theater equipment. You control both through a Windows-based graphical interface, a big improvement on the procedural language that some of these boxes required in the past.

The HouseLinc may be more powerful than you need. If you just want to turn lights on and off on schedule, the venerable X-10 CP-290 controller and some inexpensive shareware will do the job. You program the CP-290 from your PC with a serial cable, then disconnect it and let it run. Most CP-290 packages come with software, but most of it is lame and hard to use. Shareware authors have maximized the power of the CP-290, and I've been very pleased with X-10 Windows Control, a shareware program by David Huras (www.hotfiles.com; search for "X-10 Windows Control"). If you have an old PC that you can leave running and connected to the CP-290, the software will adjust for sunrise/sunset times and daylight savings time, so you can have lights go on at either explicit or variable times, such as "15 minutes before sunset."

The HouseLinc does all this and more. Its internal clock is more sophisticated than the CP-290's, so it doesn't require continuous connection to a PC but still adjusts for sun time. If you do leave it hooked up, however, the Plato software gives you a sophisticated interface to your entire house. You create an icon for every X-10 device, group the devices into rooms or functions, and operate them by clicking their icons. You can also use a drawing or architectural program to create a floor plan of your house and position the devices in their rooms and around the house. Better still, you can load in scanned or digital photos of your rooms and click on the actual objects you want to control.

Unlike the CP-290, the HouseLinc receives X-10 com-

mands as well as sending them. This allows you to trigger macros or operate groups of devices from a single X-10 switch or keypress anywhere in your house. You can also trigger infrared events from X-10 commands and vice versa.

On the infrared side, the HouseLinc has the guts of a OneForAll 8 inside—a universal remote control that knows the codes for thousands of consumer electronics devices. You select your devices by type and name from a setup menu. I had it controlling my home theater in minutes. Since I already have extensive X-10 devices throughout the house, a single button could turn on the system, dim the lights, and start the movie. But what if your components are inside a cabinet, or even in another room? No problem. The HouseLinc has four addressable infrared ports on its back into which you can plug inexpensive emitters that you've positioned inside cabinets.

With the right aftermarket accessories you can mute the TV and turn on the front porch light when the doorbell rings. Or turn on the lawn sprinklers if you aren't interested in receiving visitors. On a more practical note, the macro capability could be a boon to the hearing-impaired, as it could flash a designated light in every room for the doorbell, the phone, or other attention-demanding situations. Plato's flexible input abilities let people with severe motion impairments control anything in the extensive X-10 or infrared repertoire with a simple Windows voice control program.

If you're not steeped in home control and X-10, you can't fully appreciate the range and variety of devices that can be controlled or the interfaces through which you can interact. To the best of my knowledge, the best source of such devices (and very competitive prices) is Home Automation Systems (smarthome.com). HAS's extensive catalog is almost overwhelming in its selection of switches, sensors, smart devices, controls, touch panels, and displays. You can build a complete security system or automate a home right down to drapes that close when the room is too sunny.

Who'd have thought that being a couch potato could be this much fun? **PA**



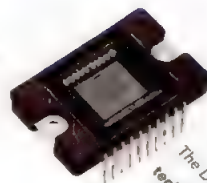
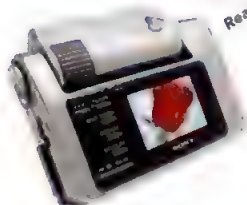
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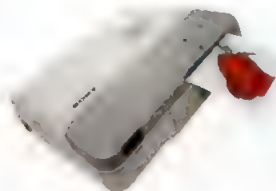
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Eiffel and the Attack on Java

With the intense bickering over the future of the Java standard, a vanguard of new language technologies is emerging and should reintroduce diversity to the development community. One of the most interesting is Eiffel, from Interactive Software Engineering

(ISE) in Goleta, California. Developers are flocking to this language in an underground torrent like nothing I've seen. And it's no wonder: The entire programming package starts at \$395 for Windows 95 or NT (a Linux version is also available) and apparently can do everything except slice bread. Newcomers to programming, take note. You can download a free trial of the environment from www.eiffel.com, or call ISE at 805-685-1006.

According to its adherents, Eiffel is more complete than Java, more robust, more versatile, and easier to code. The object-oriented programming community has long been aware of Eiffel, as ISE's president is none other than the godfather of object-oriented programming, Bertrand Meyer. His remarkable books on the subject include *Object-Oriented Software Construction*, which is arguably the definitive work on the subject.

Eiffel was first presented to the OOP-SLA (object-oriented programming systems, language, and applications) crowd in 1986, when it became the rage. Allegedly, Bill Joy of Sun once commented that Eiffel was the single best development language in the country. Over the years, Eiffel has been used mostly for difficult projects, since it has a reputation as the programming language you turn to when nothing else works. The strength of the language lies in the ease in which modules can be reused and in the structure, which makes it easy to pass the code from person to person. You can also easily embed Java code within an Eiffel module.

The irony of the entire Java-versus-Microsoft battle is that it has focused attention on alternative languages. I was told by ISE that when Java first hit the scene, sales of Eiffel dropped as people rushed to see what Java was all about. Java was the second coming of programming—at first. Now, Eiffel sales are greater than ever and growing faster than before. In fact, Java may be losing ground as this column is being written, and Microsoft's recent attacks are not helping matters.

The market is waking up to new ideas after years of watching Borland match wits with Microsoft over various

implementations of C and C++, leaving Microsoft as king of the hill. But the entrance of Java onto the scene has reinvigorated the notion that C++ is not the only language in the world. This idea is exacerbated by bickering and is causing light to be shed on other languages such as Eiffel, Clarion's TopSpeed, and even Ada.

Two factors are at work that will cause a revolution in the way people approach programming in the 21st century.

1. Microsoft is spread thin and is being spread thinner every day that it spends most of its energy trying to find something to do with its profits. Hint: How about giving the profits to the shareholders, as you're supposed to do!?! So Microsoft starts MSNBC and buys WebTV and any software company that it can reengineer. Gates is involved in an elaborate house project, satellites, and other ventures. Without Borland or any other language company forcing change, Microsoft can sit on its C++ resource and coast. When Java comes along, Microsoft panics, but it has yet to find a perfect strategy to defeat the Java juggernaut. Microsoft looks weak in the process, and developers begin to feel more comfortable using non-Microsoft language development systems.

2. Sun is without a strategy for Java. This is the company that has preached "open," "open," "open"—and users discover that preaching is just a veneer of marketing hype. Worse, Sun is a company with basically mediocre marketing skills,

following the pattern of Digital Equipment Corp.: great engineering, period. The sudden emergence of Java as a big deal surprised Sun as much as anyone. But instead of cutting it loose like a shark that could eventually grow to eat Microsoft, the company has decided to control the Java direction and future implementations to excess. By charging hefty fees for licenses and turning into control freaks, Sun itself will eventually ruin any chance of Java's actually damaging Microsoft. The language will slowly devolve into a client-side mini-applet/Web language and nothing more. In the meantime, look for Eiffel and other hot alternative languages to become what Java was supposed to be.



ACCORDING TO ITS adherents, Eiffel is more complete than Java, more robust, more versatile, and easier to code.

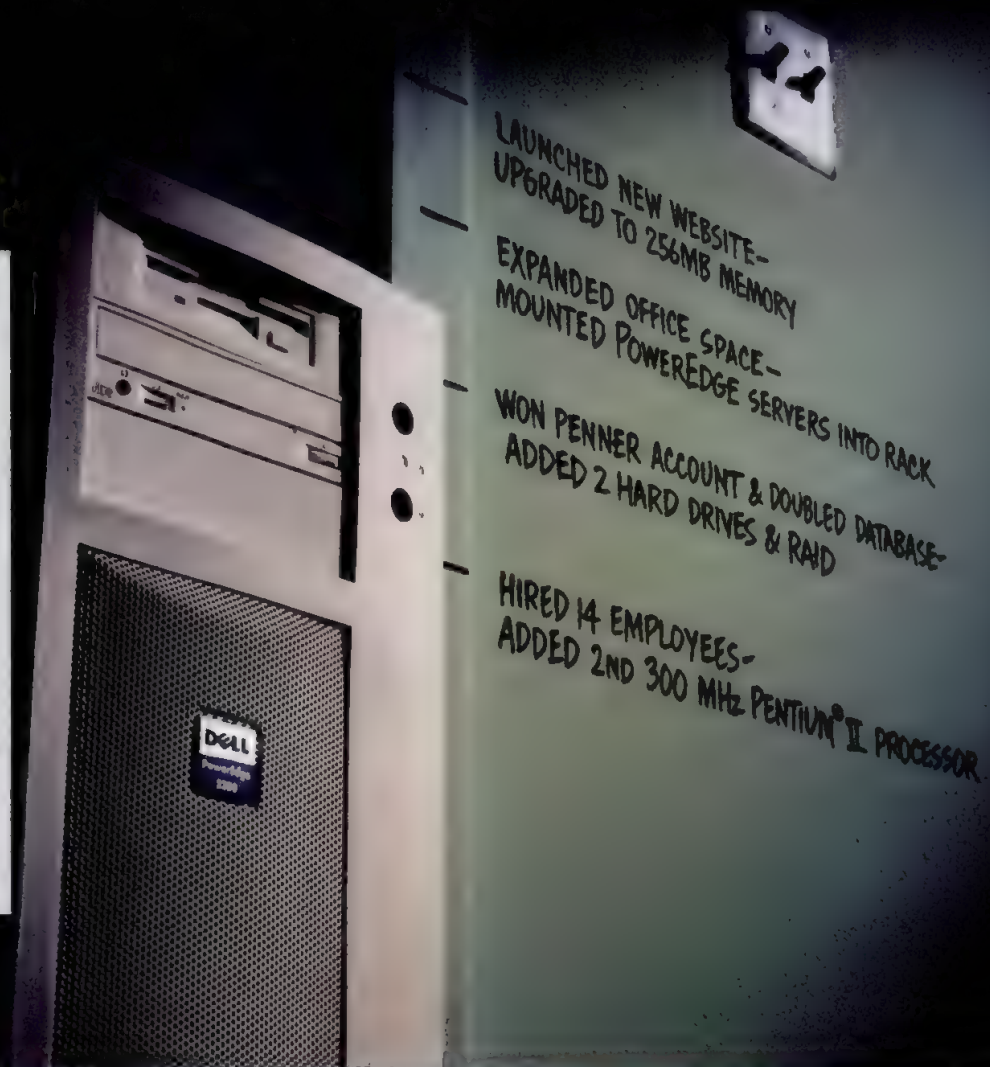
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Inside Track

Low-Cost Mania Strikes Intel Dept.: I'm not sure whether it was the recent Embedded Systems Conference, the shifting market, or National Semiconductor that made this happen, but Intel is now in the **low-end battle** and intends to fight it out to the death.

It appears that **loaded** sub-\$1,000 machines are going to be the next major trend in small computing. Intel has changed many of its plans and looks to focus on this segment of the market. This shift might explain why makers of premium, high-end Pentium servers, such as Micron, have designed their own proprietary **high-performance motherboards**. These manufacturers got wind of Intel's changes early, I suspect. Although Intel seems to be continuing to manufacture desktop PC and server motherboards, the company has reportedly stopped development on the Hood River motherboard, which was designed for high-end home entertainment systems, and switched to the low end.

Earliest on the bandwagon is Compaq, which triggered the market with a machine based on the Cyrix Media GX chip. When the machine was announced, naysayers cited market research that indicated there was no market for such machines. My thinking has been that the sub-\$1,000 market languished because it **needed a brand name** to make it legitimate. National Semiconductor has announced the intention of producing integrated microprocessors specifically for this market. The company recently acquired Cyrix and other firms as part of a **grand scheme**. And try to get a look at the new National Semiconductor logo: a strangely shaped N. I swear it's a **Klingon symbol** of some sort. I know I saw it on a "Star Trek" episode.

I had an Intel executive on my radio show during the release of the Pentium MMX chip, and I asked him point-blank about low-end strategy. He swore that the company would **never engage in such a market**. But Intel's change of mind is a good sign, not a bad one.

While dabbling in the mass market, Intel is also hoping to **kick Motorola in the shin** by going after one of Motorola's top markets: the automobile. Motorola essentially owns the market for on-board computers in today's cars. But these chips are used to control the functioning of the car. What about chips for, say, an **on-board wireless link to the Internet** and a GPS? This is the new market, and Intel wants it. The famed Society of Automobile Engineers (SAE) is hoping to get a lock on a standard for a bus (the **ITS—Intelligent Transportation System**—data bus) for these new chips so that a market of add-ins will evolve. Some observers believe that the **entire innards** of a 21st-century car will be bus-based and computer-controlled. All

*It appears that loaded
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to focus on this
segment of the market.*

devices will plug into a bus, which makes for easy interchange and upgrading—and also makes everything in the car a peripheral and subject to crashes and necessary rebooting! "But officer, the computer crashed, and the speedometer said I was stopped!"

There are already some networks in cars, which link the engine, airbags, brakes, and transmission for various forms of data interchange. So the idea is **not alien** to car makers. According to *EE Times*, "The ITS Data Bus is moving forward on parallel tracks. The UART version of the bus—which should be voted on before year's end—has a 115-kbit/second data-transfer rate, which is suitable for pagers and cellphones. A higher-speed version, aiming at 100-Mbits/second and targeted for DVD and other

multimedia devices, is currently being debated."

Intel has been pushing something called the Connected Car PC Concept, which is based on the current Intel PC architecture. Citroen showed a concept car using this technology; you could **get your e-mail while driving** and have it read to you. Sheesh, how plugged in do we need to be to make a buck?

More Embedded Systems News: Two major events happened at the Embedded Systems Conference. One was Sun's announcement that its EmbeddedJava platform was delayed, probably until next year, as performance issues seem to be **creeping** into the debate more than ever. In the process, there is more and more talk of a **Java OS** coming from Sun. While Microsoft is freaked by this, I don't see where it fits into the general computing picture.

The other curiosity at the conference was the movement toward **32-bit embedded applications**. There was even some discussion as to the possibility of incorporating Windows CE into embedded apps. Hmm. Let me think. **Bloated code to run the home appliances**. "Honey, where's the Reset button for the washer? It's stuck in the spin cycle!"

Finally, **News for the Paranoid Dept.:** A lot of people were suspicious of Microsoft when it tried to buy Intuit. "I don't want Microsoft to have access to my bank account!" was a constant theme. Well, what if Microsoft did have **access to your mailing patterns**? This access is a possibility, as Microsoft just invested in E-Stamp, a scheme to allow home computer users to use their printers to **affix postage**. Using a data collection device hooked to the printer, you buy **virtual postage** from E-Stamp, then stamp your envelope with a computerized, meterlike E-Stamp and send it off. Seems like a good idea. The post office is in the process of approving the concept. Of course, it seems to me that if **you're so hip** as to get your postage from the Internet, you ought to be doing your mailing on the Net in the form of e-mail! **PC**

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Life in the 300-MHz Lane

Progress in PCs never fits the nice, linear, evolutionary scheme of industry analysts' time lines. Rather, we lurch forward, stall for a while, get bumped sideways a little, pause, lurch again. And as much as we (and vendors) like to think new products mark big,

definitive steps forward, most new products are only modest incremental improvements—if that.

But I think the advent of the 300-MHz Pentium II chip, and of the best of the machines using it, really does mark one of those important, sea-change moments. This change, however, is not necessarily reflected on the raw-performance axis, that easiest but most deceptive of measures.

Fast Pentium II boxes, both the usual desktop models and the new generation of Windows NT workstations, are laying the groundwork for the next generation of personal computing. They will absolutely accelerate the move to Windows NT on our desktops, which will be powerfully evident in 1998. With both Windows 98 and NT 5.0 available next year, users will have a chance to compare features and power, and choose their future.

I don't knock the Win 98 upgrade. It's a worthwhile improvement, especially with its support for multiple monitors, and if you're a Windows 95 user, you should consider it. But, especially driven by the new class of PII boxes, a lot of us are going to forsake Windows 9x next year and make the leap to Win NT. Win 9x is on its last legs; don't look for a follow-up act after Win 98, Bill Gates says.

Windows NT is a much better choice in the Pentium II era. Win NT uses large RAM installations much better—and you're going to want at least 64MB in any new PII box you buy. Windows NT supports multiple CPUs, and even if you start with one CPU, there's a good chance that within a year or so you'll be adding a second PII chip. (What? Processor upgrades that finally make sense? Yes.)

I've been working with a lot of the new 300-MHz PII machines lately. I've found three that I especially like: the Micron Powerdigm XSU, Dell WorkStation 400, and Gateway G6-300XL. The first two are tagged as workstations, which means they're more powerful than the desktops we're accustomed to and have expensive high-performance 3-D graphics card options. Gateway's machine is positioned as a high-end desktop PC.

Briefly: The Micron XSU is simply the fastest, most

powerful PC I've ever used—the most exciting PC on the planet. With one Pentium II/300 CPU, 64MB of RAM, and a 4GB Fast/Wide Ultra-SCSI 3 hard disk, the Micron is \$6,200—not cheap, but the absolute best never is. Bump the RAM up to 128MB, add a second CPU, and move up to a

9GB hard disk and the price increases to \$7,300, which I think is a very good investment indeed. Micron's in-house Samurai chip set cranks the PCI bus up to the 64-bit, 66-MHz level and accounts for much of the Micron XSU's edge over every other fast PII box now available.

Dell's WorkStation 400, a close second to the Micron, costs \$5,200 and \$7,400, respectively, in similar configurations. Both companies include Windows NT, 19-inch monitors, and mini-tower boxes, and in both cases you can spend another \$1,000 for a very high-end, workstation-class 3-D graphics board.

Gateway's full-tower G6-300XL, with one 300-MHz PII CPU, an 8.4GB Ultra ATA (EIDE) hard disk, 64MB of RAM, a 19-inch monitor, and Win 95 costs just \$3,300—an amazing buy.

There are certainly other good 300-MHz PII machines available; those three top the list, in my experience.

But do *you* need a 300-MHz machine? Is the performance increase over a 266-MHz PII, a 233-MHz PII, or even a 200-MHz Pentium Pro dramatic? Does a second CPU double the speed of the computer? Some buying tips follow, based on my evaluations for corporate clients and

my personal experience with many of these machines.

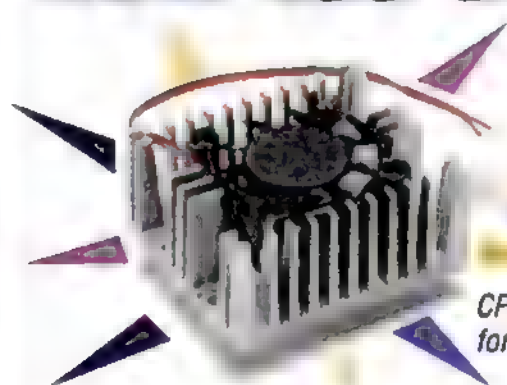
Realistic expectations. None of these machines will double or triple the perceived speed of most apps over, say, a Pentium Pro/200. On the average, I saw about a 25 percent improvement in raw speed on typical apps between my reference Pentium Pro/200 machine and the high-end Micron Powerdigm XSU when both were running Windows 95. Under Windows NT, the gap opened a little wider—about another 20 to 25 percent—but there were no skid marks on my desktop when I finished my evaluations. In buying a fast Pentium II machine, you're positioning yourself for two or three years of high-performance computing before the lust



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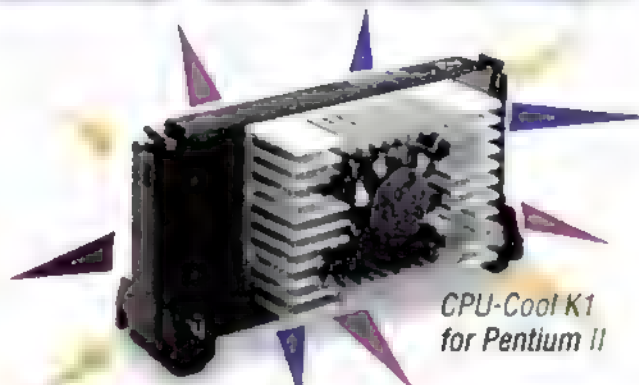
The \$2,500-to-\$3,000 266-MHz PII machines now on the market are incredible bargains.

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JIM SEYMOUR

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Hmmm... 233, 266, 300? If you want the best, fastest, and longest-lived on-the-edge box, buy a 300-MHz PII. I love 'em, and you will, too. I think 300-MHz PIIs are the right choice for power users, at home or in the office. But I found that the difference in speed between the average 233-MHz box and the fastest 300-MHz (both with 64MB of memory and running Windows NT) was only about 5 to 10 percent. Between 266-MHz and 300-MHz machines, the difference was all but imperceptible: maybe 1 or 2 percent. The \$2,500-to-\$3,000 266-MHz PII machines on the market right now are incredible bargains.

Do you want a high-end 3-D graphics board? The *fasstt* 3-D graphics boards are impressive—if you're running workstation-style 3-D design programs. But they're not even close to being worth their \$1,000 additional cost for those of us using conventional apps—even most PC graphics apps.

Ultra ATA (EIDE) or SCSI? Even with the new Ultra ATA drives, SCSI-2 and Ultra SCSI-3 have a speed advantage. You'll probably want to daisy-chain some SCSI peripherals off the machines in this class, so why not go for the SCSI performance edge across the board?

Second CPU? Not necessary today. Adding a second CPU just doesn't do much for desktop apps yet. (Second CPUs do scale up performance nicely on servers, of course.) Next year, we'll see better use of symmetrical multiprocessing in apps and in Windows NT Workstation 5.0, and that second CPU will be a bargain-price performance booster. (Of course, if you have the extra dough now—or the right kind of expense account—there's nothing wrong with getting a second CPU installed when you buy a machine.)

Memory, memory, memory! Get at least 64MB of RAM in your PII box. For serious graphics—and for general use if you like to have lots of apps open and running at the same time—go for 128MB. In my tests, *adding more RAM was always more cost-effective than upping the CPU speed or adding a second CPU.*

The Windows NT Workstation market is about to explode. As new PII workstations are arriving almost every day, I'll get back to you in a couple of issues with more on these powerhouses. But don't read that as a coded hint to wait; today's 300-MHz PIIs are great machines, at the right prices. **PC**

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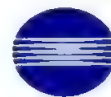
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"I Have a Gub"

Remember *Take the Money and Run*? Woody Allen hands a bank teller a hastily scribbled holdup note. The teller hands it back, because he thinks it reads, "I have a gub." Sorry: no gun, no money. Every time I stick a sheet of paper in my scanner and run OCR,

that scene in the movie comes to mind.

In the two-steps-forward, one-step-back world of PC productivity, scanning—for me—has been one of the more useful tools, both professionally and personally. I've scanned photos, text documents, business cards, and forms, and I've worked with flatbed, personal sheet-fed, and business-card scanners. The tools are pretty good. But they're a long way from perfect. Here's my take on scanners and scanning as of late 1997.

• **Personal scanners.** These are the devices, popularized by Visioneer with its PaperPort scanner, that are about the size of a box of aluminum foil. You feed a sheet of paper in one side and it rolls out the other. Virtually all the devices now scan in color. They're great for everything except bound volumes, though there's the neat Logitech device, the PageScan Color, whose scan head can be separated from its stand to scan bound articles. None of the devices has it all: color scanning, removable scan head, sheet feeder, and great software. Visioneer has the best software (PaperPort, its own), while we've found Logitech and UMAX currently have better hardware. (In testing, early models of the new Visioneer Strobe were mediocre on color.) If you get only one scanner, this is the type I'd recommend.

• **Personal scanner software.** I've used PaperPort software for several years; I'm approaching 250MB of scanned documents, and I'm finding the material is becoming a bit unwieldy. So far, there's no satisfactory way to pare off your older documents or to share some of your files with coworkers in a common database. Xerox's Pagsis Pro is a bit better for high-end users, but it's not as simple to use. The OCR software bundled with many scanners is often last year's edition.

• **Flatbed scanners.** For the best scan quality, or if you need to scan bound documents, you want a flatbed scanner. Good flatbed scanners are now well under \$500 (see our First Looks roundup in the November 4 issue). But for many users, the quality improvement isn't enough reason to warrant living with such a scanner's bulk on the

desktop—even if the size of flatbeds has decreased considerably.

• **Photo scanners.** They're one-trick ponies. They handle only color photos measuring up to 4 by 6 inches. If that's what you want, and if you can spare an interrupt request (IRQ) on models that use a proprietary card connection, good for you. They're certainly cheap enough.

• **Business-card scanners.** The technology almost works now. By that, I mean that you can scan in a business card and have pretty fair assurance that most of the information will scan properly, be converted to text properly, and go into the proper fields. I've had good luck with Corex's CardScan and its Version 3.0 software. (Seiko Epson makes a similar card scanner.)

But business-card scanning is still a time sink. As a test, I scanned in 500 business cards. It took 90 minutes to feed in the cards (5 to 6 per minute), 120 minutes for my computer to run OCR, and another 150 minutes to make manual corrections in the most important fields. Before I made corrections, better than 9 of every 10 cards had the names, phone numbers, and e-mail addresses correct or close enough. Even so, expect to waste time laughing over dumb mistakes the scanner makes, because it can't read reverse (white-on-black) or stylized logos, and it has big trouble with italics.

• **Multifunction peripherals.** The newest models of these printer-fax-copier-scanners

work in color at 300 dpi, and that's good enough for most users. They work through parallel ports, so color scans of big images will take a long time.

While all of the devices are good right now, I'm not satisfied with the connections, whether serial, parallel, or parallel with a printer pass-through. (SCSI is best, albeit pricey, and you have to open up your PC.) Multifunction peripherals cry out to be connected over USB (Universal Serial Bus) ports, and you'll see them become widely available in the first half of 1998, possibly even the first quarter. This is one of the few times when it might pay to wait before buying. **PC**



SCANNERS

The tools are pretty good. But they're quite a long way from being perfect.

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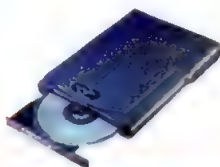
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Satellite 220CDS	133MHz Pentium	16MB/144MB	1.34GB	10X	12.1" dual scan	-	Lithium ion battery	\$1589.93	89777
Satellite Pro 440CDX	133MHz Pentium MMX	16MB/144MB	1.34GB	10X	12.1" dual scan	-	Lithium ion battery	\$1989.89	90351
Satellite Pro 440CDT	133MHz Pentium MMX	16MB/144MB	1.34GB	10X	12.1" active matrix	-	Lithium ion battery	\$2679.77	90352
Satellite Pro 460CDT	166MHz Pentium MMX	32MB/160MB	2.02GB	10X	12.1" active matrix	33.6K bps	Lithium ion battery	\$3659.16	90353
Portege 300CT	133MHz Pentium MMX	32MB/64MB	1.5GB	-	10.4" active matrix	33.6K bps	external floppy	\$3369.46	90354
Portege 660CDT	150MHz Pentium	16MB/80MB	1.2GB	10X	11.3" active matrix	28.8K bps	external floppy	\$3099.63	77243
Tecra 510CDT	133MHz Pentium	16MB/144MB	2.1GB	10X	12.1" active matrix	28.8K bps	16-bit stereo sound	\$2489.48	77241
Tecra 520CDT	166MHz Pentium MMX	32MB/160MB	2GB	10X	12.1" active matrix	33.6K bps	SVGA resolution	\$4159.45	90355
Tecra 530CDT	166MHz Pentium MMX	32MB/160MB	2GB	10X	12.1" active matrix	33.6K bps	XGA resolution	\$4679.17	90359
Tecra 730XCDT	150MHz Pentium MMX	16MB/144MB	2GB	10X	12.1" active matrix	28.8K bps	full duplex speakerphone	\$3499.77	80957
Tecra 740CDT	166MHz Pentium MMX	16MB/144MB	3GB	10X	13.3" active matrix	28.8K bps	video conferencing kit	\$4849.62	87964
Tecra 740CDT	166MHz Pentium MMX	16MB/144MB	3GB	10X	13.3" active matrix	28.8K bps	Windows NT V4.0	\$4999.31	87965
Tecra 750CDT	233MHz Pentium MMX	32MB/160MB	4.7GB	20X	13.3" active matrix	56K bps	32-bit PCI bus	\$8449.23	98534

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380E	150MHz Pentium MMX	16MB/80MB	2.1GB	-	12.1" dual scan	-	SVGA resolution	\$1939.22	94541
380ED	166MHz Pentium MMX	16MB/80MB	2.1GB	20X	12.1" dual scan	-	SVGA resolution	\$2429.85	94542
380ED	166MHz Pentium MMX	16MB/80MB	3GB	20X	12.1" active matrix	-	16-bit stereo sound	\$3329.44	94543
560	133MHz Pentium	8MB/40MB	2.1GB	-	12.1" active matrix	-	external floppy	\$2429.85	81186
560E	150MHz Pentium MMX	16MB/80MB	2.1GB	-	11.3" dual scan	-	16-bit stereo sound	\$2149.25	89290
560E	166MHz Pentium MMX	16MB/80MB	2.1GB	-	12.1" active matrix	-	16-bit stereo sound	\$3719.51	89291
560X	233MHz Pentium MMX	32MB/96MB	4GB	-	12.1" active matrix	-	16-bit stereo sound	\$4499.17	98309
760XL	166MHz Pentium MMX	16MB/104MB	2.1GB	optional	12.1" active matrix	-	16-bit stereo sound	\$3769.88	84102
760XD	166MHz Pentium MMX	32MB/104MB	3GB	8X	12.1" active matrix	28.8K bps	XGA resolution	\$4599.98	84101
765L	166MHz Pentium MMX	32MB/104MB	3GB	-	13.3" active matrix	-	16-bit stereo sound	\$4997.63	89293
765D	166MHz Pentium MMX	32MB/104MB	3GB	8X	13.3" active matrix	28.8K bps	Mwave DSP subsystem	\$5499.91	89292
770	200MHz Pentium MMX	32MB/160MB	3.2GB	-	13.3" active matrix	-	Lithium ion battery	\$4999.39	94545
770	233MHz Pentium MMX	32MB/160MB	4GB	-	13.3" active matrix	-	Lithium ion battery	\$6469.16	94544
770	233MHz Pentium MMX	32MB/160MB	4GB	-	13.3" active matrix	-	Windows NT V4.0	\$5899.36	94546
770	233MHz Pentium MMX	32MB/160MB	5.1GB	-	14.1" active matrix	33.6K bps	Lithium ion battery	\$8779.06	94547

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1540DM	150MHz Pentium MMX	16MB/80MB	2.1GB	20X	12.1" dual scan	33.6K bps	SVGA resolution	\$2199.89	96613
1550DMT	133MHz Pentium	16MB/80MB	1.4GB	10X	12.1" active matrix	33.6K bps	full duplex speakerphone	\$2449.71	87070
1580DMT	150MHz Pentium MMX	16MB/80MB	2.1GB	10X	12.1" active matrix	33.6K bps	full duplex speakerphone	\$2739.76	90959
1590DMT	166MHz Pentium MMX	16MB/80MB	2.1GB	20X	12.1" active matrix	33.6K bps	SVGA resolution	\$3169.62	96612
4130T	133MHz Pentium	16MB/48MB	1.08GB	-	11.8" active matrix	-	16-bit stereo sound	\$1859.66	71116
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4150	150MHz Pentium MMX	16MB/80MB	1.6GB	-	12.1" dual scan	-	16-bit stereo sound	\$2139.30	91508
4160T	166MHz Pentium MMX	16MB/80MB	2GB	-	12.1" active matrix	-	16-bit stereo sound	\$3399.00	91509
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7330T	150MHz Pentium MMX	16MB/128MB	2.1GB	-	12.1" active matrix	-	16-bit stereo sound	\$3299.00	93735
7350MT	166MHz Pentium MMX	32MB/128MB	2.1GB	-	12.1" active matrix	33.6K bps	16-bit stereo sound	\$3799.00	93736
7710MT	150MHz Pentium MMX	16MB/144MB	1.6GB	optional	12.1" active matrix	33.6K bps	64-bit PCI bus	\$2799.00	88242
7730MT	166MHz Pentium MMX	32MB/144MB	2.1GB	optional	12.1" active matrix	33.6K bps	64-bit PCI bus	\$4399.00	88241
7750MT	166MHz Pentium MMX	32MB/144MB	2.1GB	optional	12.1" active matrix	33.6K bps	64-bit PCI bus	\$4999.00	88240
7770DMT	233MHz Pentium MMX	32MB/144MB	3GB	20X	12.1" active matrix	33.6K bps	64-bit PCI bus	\$4999.00	96735



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Notebooks

Model	Processor	RAM std. max.	Hard drive	CD-ROM	Color display	Modem	Features	Price	CDW
Compaq Presario									
1210	150MHz Pentium	16MB/80MB	1.4GB	14X	12.1" dual scan	33.6K bps	16-bit stereo sound	\$1999.00	90514
1610	150MHz Pentium MMX	16MB/80MB	1.6GB	14X	12.1" dual scan	56K bps	16-bit stereo sound	\$2399.00	90515
1620	166MHz Pentium MMX	16MB/80MB	2.1GB	20X	12.1" dual scan	56K bps	16-bit stereo sound	\$2599.00	90598
1585DMT	150MHz Pentium MMX	16MB/80MB	2.1GB	12X	12.1" active matrix	33.6K bps	16-bit stereo sound	\$2799.00	92232

AST Ascentia

M5130S	133MHz Pentium MMX	32MB/128MB	1.6GB	20X	12.1" dual scan	-	Lithium ion battery	\$2399.88	95321
M5160T	166MHz Pentium MMX	32MB/128MB	1.6GB	20X	12.1" active matrix	-	SVGA resolution	\$2948.24	96484
M5200T	200MHz Pentium MMX	32MB/128MB	2.1GB	20X	12.1" active matrix	56K bps	SVGA resolution	\$3489.28	96485
M5160X	166MHz Pentium MMX	32MB/128MB	2.1GB	20X	13.3" active matrix	56K bps	XGA resolution	\$3889.28	96507
M5230T	233MHz Pentium MMX	32MB/128MB	3.3GB	20X	12.1" active matrix	56K bps	SVGA resolution	\$4299.58	96488
M5230X	233MHz Pentium MMX	64MB/128MB	4GB	20X	13.3" active matrix	56K bps	XGA resolution	\$6299.39	96486

Acer Texas Instruments

Extensa 610CD	150MHz Pentium	16MB/64MB	1.4GB	10X	11.3" dual scan	-	external floppy	\$1984.87	88530
Extensa 610CDT	150MHz Pentium	16MB/64MB	1.4GB	10X	11.3" active matrix	-	external floppy	\$2549.84	88531
Extensa 670CD	166MHz Pentium MMX	16MB/80MB	1.6GB	10X	12.1" dual scan	-	16-bit stereo sound	\$2699.29	95273
Extensa 670CDT	166MHz Pentium MMX	32MB/80MB	2.1GB	10X	12.1" active matrix	-	SVGA resolution	\$3398.45	95275
TravelMate 7060	166MHz Pentium MMX	32MB/64MB	2GB	10X	12.1" active matrix	33.6K bps	16-bit stereo sound	\$4289.59	88471
TravelMate 7063NT	166MHz Pentium MMX	32MB/64MB	3GB	10X	12.1" active matrix	33.6K bps	Windows NT V4.0	\$4848.69	88472

Fujitsu LifeBook

555Tx	150MHz Pentium MMX	16MB/80MB	2GB	10X	12.1" active matrix	33.6K bps	16-bit stereo sound	\$3199.00	85008
565Tx	166MHz Pentium MMX	32MB/96MB	2GB	20X	12.1" active matrix	33.6K bps	XGA resolution	\$4299.00	92055
635Tx	133MHz Pentium MMX	16MB/80MB	2GB	16X	12.1" active matrix	33.6K bps	16-bit stereo sound	\$3199.00	92058
655Tx	150MHz Pentium MMX	16MB/80MB	1.3GB	8X	12.1" active matrix	33.6K bps	external floppy	\$3799.00	85013
656Tx	150MHz Pentium MMX	16MB/80MB	2GB	16X	12.1" active matrix	33.6K bps	SVGA resolution	\$4299.00	92061

Hitachi VisionBook

4150x	150MHz Pentium MMX	16MB/128MB	1.4GB	10X	12.1" dual scan	33.6K bps	16-bit stereo sound	\$2299.00	91047
4380x	166MHz Pentium MMX	16MB/128MB	2.1GB	10X	12.1" active matrix	33.6K bps	SVGA resolution	\$2999.00	91049
7340	133MHz Pentium MMX	16MB/144MB	1.4GB	10X	12.1" active matrix	56K bps	16-bit stereo sound	\$2999.00	91051
7360	166MHz Pentium MMX	32MB/144MB	2.1GB	10X	12.1" active matrix	56K bps	16-bit stereo sound	\$4299.00	91053
7580	166MHz Pentium MMX	32MB/144MB	3GB	10X	13.3" active matrix	56K bps	XGA resolution	\$4799.00	91054
8580	166MHz Pentium MMX	16MB/80MB	2.1GB	10X	13.3" active matrix	56K bps	XGA resolution	\$4599.00	91056

Hewlett-Packard OmniBook Notebook PCs

800CT	166MHz Pentium MMX	16MB/80MB	2GB	-	10.4" active matrix	-	external floppy	\$3719.18	85727
2000CS	133MHz Pentium	16MB/128MB	1.4GB	-	12.1" dual scan	-	SVGA resolution	\$2049.50	88749
2000CT	133MHz Pentium	16MB/128MB	1.4GB	-	12.1" active matrix	-	32-bit PCI bus	\$2344.23	88750
2000CT	133MHz Pentium MMX	16MB/128MB	2GB	-	12.1" active matrix	-	32-bit PCI bus	\$2699.97	88751
5700CT	150MHz Pentium MMX	16MB/128MB	1.8GB	optional	12.1" active matrix	-	16-bit stereo sound	\$2999.15	85720
5700CT	166MHz Pentium MMX	16MB/128MB	1.8GB	optional	12.1" active matrix	-	16-bit stereo sound	\$3369.92	85721
5700CTX	166MHz Pentium MMX	16MB/128MB	1.8GB	optional	12.1" active matrix	-	XGA resolution	\$3459.82	85723
5700CTX	166MHz Pentium MMX	32MB/128MB	2.7GB	optional	12.1" active matrix	-	XGA resolution	\$4039.53	85722

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- Pre-loaded Windows® 95

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Fujitsu

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- 150MHz Intel Pentium® MMX
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Desktops

Model	Processor	Chassis	RAM std./max	Hard drive	CD-ROM	Video	Modem	Price	CDW
Compaq Deskpro 2000									
5166X/2100	166MHz Pentium MMX	desktop	16MB/384MB	2.1GB	optional	S3 Trio64V2/GX	-	\$1059.00	92269
5166X/3200	166MHz Pentium MMX	desktop	16MB/384MB	3.2GB	optional	S3 Trio64V2/GX	-	\$1109.00	92838
5166X/3200	166MHz Pentium MMX	mini-tower	16MB/384MB	3.2GB	16X Max	S3 Trio64V2/GX	-	\$1429.00	92830
5200X/2100	200MHz Pentium MMX	desktop	16MB/384MB	2.1GB	optional	S3 Trio64V2/GX	-	\$1179.00	92840
5200X/3200/CDS	200MHz Pentium MMX	mini-tower	32MB/384MB	3.2GB	16X Max	S3 Trio64V2/GX	-	\$1549.00	92842
5200X/3200	200MHz Pentium MMX	desktop	32MB/384MB	3.2GB	optional	S3 Trio64V2/GX	-	\$1539.00	92841
5233X/3200/CDS	233MHz Pentium MMX	desktop	32MB/384MB	3.2GB	16X Max	S3 Trio64V2/GX	-	\$1719.00	92843
6233X/2100	233MHz Pentium II	desktop	32MB/384MB	2.1GB	optional	Matrox 1064-SG	-	\$1749.00	95916
6233X/3200/CDS	233MHz Pentium II	desktop	32MB/384MB	3.2GB	24X Max	Matrox 1064-SG	-	\$1899.00	95917
6266X/3200/CDS	266MHz Pentium II	desktop	32MB/384MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2209.00	95918
6266X/3200/CDS	266MHz Pentium II	mini-tower	32MB/384MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2239.00	95919
6300X/3200/CDS	300MHz Pentium II	mini-tower	32MB/384MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2579.00	95920
Compaq Deskpro 4000									
5166X/2400	166MHz Pentium MMX	desktop	16MB/256MB	2.4GB	optional	S3 VIRGE/GX	-	\$1279.00	92844
5166X/3200	166MHz Pentium MMX	desktop	32MB/256MB	3.2GB	optional	S3 VIRGE/GX	-	\$1449.00	92845
5166X/3200/CDS	166MHz Pentium MMX	mini-tower	32MB/256MB	3.2GB	16X Max	S3 VIRGE/GX	-	\$1649.00	92846
5200X/2400	200MHz Pentium MMX	desktop	32MB/256MB	2.4GB	optional	S3 VIRGE/GX	-	\$1509.00	92847
5200X/3200	200MHz Pentium MMX	desktop	32MB/256MB	3.2GB	optional	S3 VIRGE/GX	-	\$1559.00	92848
5233X/3200X/CDS	233MHz Pentium MMX	mini-tower	32MB/256MB	3.2GB	16X Max	S3 VIRGE/GX	-	\$1919.00	92849
6233X/2400X/CDS	233MHz Pentium II	mini-tower	32MB/256MB	2.4GB	optional	Matrox 1064-SG	-	\$1649.00	95921
6233X/3200X/CDS	233MHz Pentium II	mini-tower	32MB/256MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2109.00	95922
6266X/3200X/CDS	266MHz Pentium II	mini-tower	32MB/256MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2329.00	95924
6233X/3200X/CDS	233MHz Pentium II	mini-tower	32MB/256MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2139.00	95923
6266X/3200X/CDS	266MHz Pentium II	mini-tower	32MB/256MB	3.2GB	24X Max	Matrox 1064-SG	-	\$2359.00	95925
Compaq Deskpro 6000									
6233X/2100/CDS	233MHz Pentium II	desktop	32MB/384MB	2.1GB	24X Max	Matrox Millennium II	-	\$2399.00	95929
6266X/2100/CDS	266MHz Pentium II	desktop	32MB/384MB	2.1GB	24X Max	Matrox Millennium II	-	\$2629.00	95930
6266X/4300/CDS	266MHz Pentium II	desktop	32MB/384MB	4.3GB	24X Max	Matrox Millennium II	-	\$2929.00	95931
6300X/4300/CDS	300MHz Pentium II	desktop	64MB/384MB	4.3GB	24X Max	Matrox Millennium II	-	\$3529.00	95933
6266X/4300/CDS	266MHz Pentium II	mini-tower	64MB/384MB	4.3GB	24X Max	Matrox Millennium II	-	\$3219.00	95932
6300X/4300/CDS	300MHz Pentium II	mini-tower	64MB/384MB	4.3GB	24X Max	Matrox Millennium II	-	\$3559.00	95934
Compaq Presario									
2200	180MHz processor with MediaGX	desktop	16MB/64MB	1.9GB	8X	MPEG full-motion playback	33.6K bps	\$799.00	92852
4505	166MHz Pentium MMX	mini-tower	16MB/64MB	2.1GB	16X Max	64-bit PCI accelerated	33.6K bps	\$999.00	95066
4508	200MHz Pentium MMX	mini-tower	24MB/64MB	3.2GB	16X Max	64-bit PCI accelerated	33.6K bps	\$1199.00	90510
4528	233MHz Pentium MMX	mini-tower	32MB/64MB	3.2GB	24X Max	64-bit PCI accelerated	33.6K bps	\$1499.00	90511
4840	266MHz Pentium II	mini-tower	32MB/64MB	6.5GB	2X DVD	4MB ATI Rage Pro 3D	56K bps	\$2699.00	95064
4850	300MHz Pentium II	mini-tower	48MB/64MB	6.5GB	2X DVD	4MB ATI Rage Pro 3D	56K bps	\$2999.00	95065
IBM PC Series									
PC 300GL	166MHz Pentium MMX	desktop	32MB/128MB	2.5GB	optional	Cirrus Logic 5446	-	\$1289.32	94858
PC 300GL	166MHz Pentium MMX	desktop	16MB/128MB	2.5GB	optional	Cirrus Logic 5446	-	\$1286.81	89298
PC 300GL	200MHz Pentium MMX	desktop	32MB/128MB	2.5GB	16X Max	Cirrus Logic 5446	-	\$1879.18	89296
PC 300GL	200MHz Pentium MMX	desktop	32MB/128MB	2.5GB	optional	Cirrus Logic 5446	-	\$1449.74	95162
PC 300PL	200MHz Pentium MMX	desktop	32MB/384MB	2.5GB	optional	Matrox Mystique	-	\$1675.34	94012
PC 300PL	200MHz Pentium MMX	desktop	32MB/384MB	4.2GB	24X Max	Matrox Mystique	-	\$1839.59	94014
PC 300PL	233MHz Pentium MMX	desktop	32MB/384MB	4.2GB	24X Max	Matrox Mystique	-	\$2045.54	95759
PC 300PL	166MHz Pentium MMX	mini-tower	32MB/384MB	2.5GB	optional	Matrox Mystique	-	\$1489.23	95762
PC 300PL	200MHz Pentium MMX	mini-tower	32MB/384MB	4.2GB	optional	Matrox Mystique	-	\$1689.77	94013
PC 300PL	233MHz Pentium MMX	mini-tower	32MB/384MB	4.3GB	24X Max	Matrox Mystique	-	\$2449.58	95764
PC 300XL	233MHz Pentium II	desktop	32MB/384MB	2.5GB	16X Max	S3 Trio64V2	-	\$2259.14	86313
PC 300XL	233MHz Pentium II	desktop	32MB/384MB	2.5GB	optional	S3 Trio64V2	-	\$1975.30	86314
PC 300XL	266MHz Pentium II	desktop	32MB/384MB	4.2GB	16X Max	S3 Trio64V2	-	\$2659.12	86315
PC 300XL	266MHz Pentium II	desktop	32MB/384MB	4.3GB	16X Max	S3 Trio64V2	-	\$2925.24	86316



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Desktops

Model	Processor	Chassis	RAM std./max	Hard drive	CD-ROM	Video	Modem	Price	CDW
IBM Aptiva									
S35	233MHz Pentium MMX	mini-tower	4MB/16MB	6.4GB	24X Max	ATI 3D RAGE II	33.6K bps	\$2499.27	90538
HP Brio Series									
B012	166MHz Pentium MMX	mini-tower	16MB/128MB	2.1GB	optional	S3 Trio 64V2	-	\$999.53	90505
B014	200MHz Pentium MMX	mini-tower	16MB/128MB	2.1GB	optional	S3 Trio 64V2	-	\$1154.35	90502
B017	233MHz Pentium MMX	mini-tower	32MB/128MB	3.2GB	optional	S3 Trio 64V2	-	\$1449.95	90503
B032	166MHz Pentium MMX	mini-tower	16MB/128MB	2.1GB	16X Max	S3 Trio 64V2	-	\$1149.54	90504
B034	200MHz Pentium MMX	mini-tower	32MB/128MB	2.1GB	16X Max	S3 Trio 64V2	-	\$1419.36	90505
B037	233MHz Pentium MMX	mini-tower	32MB/128MB	3.2GB	24X Max	S3 Trio 64V2	-	\$1649.54	90506
B172	166MHz Pentium MMX	mini-tower	16MB/128MB	2.1GB	16X Max	S3 Trio 64V2	56K bps	\$1379.29	90507
B174	200MHz Pentium MMX	mini-tower	32MB/128MB	2.1GB	24X Max	S3 Trio 64V2	56K bps	\$1635.54	90508
B175	200MHz Pentium MMX	mini-tower	32MB/192MB	2.1GB	24X Max	S3 Trio 64V2	56K bps	\$1749.83	90509
B177	233MHz Pentium MMX	mini-tower	32MB/192MB	4GB	24X Max	S3 Trio 64V2	56K bps	\$1869.90	90500
B178	233MHz Pentium MMX	mini-tower	32MB/192MB	6GB	24X Max	Matrox Millennium	56K bps	\$2117.37	90501
HP Vectra VE Series 3 PC									
VE3 5/200	200MHz Pentium	desktop	16MB/192MB	1GB	optional	SIS 6205	-	\$999.00	96382
VE3 5/166M	166MHz Pentium MMX	desktop	16MB/192MB	1.6GB	optional	SIS 6205	-	\$1099.65	96383
VE3 5/200M	200MHz Pentium MMX	desktop	16MB/192MB	1.6GB	optional	SIS 6205	-	\$1199.32	96384
VE3 5/166M	166MHz Pentium MMX	desktop	16MB/192MB	1.6GB	24X	SIS 6205	-	\$1299.78	96389
HP Vectra VL Series 5 PC									
VL5 5/166M	166MHz Pentium MMX	desktop	16MB/192MB	1.6GB	optional	2MB S3 Trio64 V2	-	\$1299.96	96735
VL5 5/166M	166MHz Pentium MMX	desktop	16MB/192MB	2.5GB	24X	2MB S3 Trio64 V2	-	\$1444.89	96730
VL5 5/166M	166MHz Pentium MMX	desktop	32MB/192MB	2.5GB	optional	2MB S3 Trio64 V2	-	\$1459.70	96736
VL5 5/200M	200MHz Pentium MMX	desktop	16MB/192MB	2.5GB	optional	2MB S3 Trio64 V2	-	\$1449.95	96737
VL5 5/200M	200MHz Pentium MMX	desktop	32MB/192MB	2.5GB	24X	2MB S3 Trio64 V2	-	\$1678.26	96732
VL5 5/166M	166MHz Pentium MMX	mini-tower	16MB/192MB	2.5GB	24X	2MB S3 Trio64 V2	-	\$1499.15	96731
VL5 5/200	200MHz Pentium	mini-tower	16MB/192MB	2.5GB	24X	2MB S3 Trio64 V2	-	\$1459.01	96407
VL5 5/200M	200MHz Pentium MMX	mini-tower	32MB/192MB	2.5GB	optional	2MB S3 Trio64 V2	-	\$1626.05	96738
VL5 5/200M	200MHz Pentium MMX	mini-tower	32MB/192MB	2.5GB	24X	2MB S3 Trio64 V2	-	\$1739.59	96733
VL5 5/233M	233MHz Pentium MMX	mini-tower	32MB/192MB	4GB	24X	2MB S3 Trio64 V2	-	\$1967.75	96734
AST Bravo									
MS 5166M	166MHz Pentium MMX	desktop	32MB/256MB	3GB	16X Max	ATI 3D RAGE II	-	\$1489.33	97096
MS 5200/M	200MHz Pentium MMX	desktop	32MB/256MB	3GB	16X Max	ATI 3D RAGE II	-	\$1676.37	91570
MS 5233/M	233MHz Pentium MMX	desktop	32MB/256MB	3GB	16X Max	ATI 3D RAGE II	-	\$1799.48	95813
MS 5200/M	200MHz Pentium MMX	desktop	32MB/256MB	3GB	16X Max	ATI 3D RAGE II	-	\$1676.37	91570
MS 6266/M	266MHz Pentium II	desktop	32MB/256MB	4.3GB	24X Max	ATI 3D RAGE II	-	\$2589.64	95823
MS 6266/M	266MHz Pentium II	desktop	32MB/256MB	4.3GB	24X Max	ATI 3D RAGE II	-	\$2648.51	95822
MS 6300/M	300MHz Pentium II	mini-tower	32MB/384MB	4.3GB	24X Max	ATI 3D RAGE II	-	\$2758.78	95825
MS 6300/M	300MHz Pentium II	mini-tower	32MB/384MB	4.3GB	24X Max	ATI 3D RAGE II	-	\$2859.99	95826
LC 5166/M	166MHz Pentium MMX	desktop	16MB/256MB	2GB	optional	S3 VIRGE	-	\$986.11	93288
LC 5200/M	200MHz Pentium MMX	desktop	32MB/256MB	2GB	optional	S3 VIRGE	-	\$1166.53	95811
LC 6233/M	233MHz Pentium II	mini-tower	32MB/256MB	2GB	16X Max	S3 VIRGE	-	\$1859.83	98107
LC 6233/M	233MHz Pentium II	mini-tower	32MB/256MB	2GB	16X Max	S3 VIRGE	-	\$1759.44	98108
Acer									
Network Ready	200MHz Pentium	desktop	32MB/128MB	2.1GB	optional	64-bit PCI accelerated	-	\$996.32	91887
Network Ready	166MHz Pentium MMX	desktop	16MB/128MB	1GB	optional	64-bit PCI accelerated	-	\$938.11	96176
Network Ready	200MHz Pentium MMX	desktop	32MB/128MB	2.1GB	optional	64-bit PCI accelerated	-	\$1265.65	96178
Business MM	166MHz Pentium MMX	desktop	16MB/384MB	2.1GB	20X	64-bit PCI accelerated	-	\$1134.18	91883
Business MM	166MHz Pentium MMX	desktop	32MB/384MB	3.2GB	20X	64-bit PCI accelerated	-	\$1219.89	91884
Business MM	200MHz Pentium MMX	mini-tower	32MB/384MB	3.2GB	20X	64-bit PCI accelerated	-	\$1589.98	91885
Acer Power	166MHz Pentium MMX	desktop	16MB/384MB	2.1GB	8X	64-bit PCI accelerated	-	\$1077.36	91872
Toshiba									
Equium 5200D	200MHz Pentium MMX	desktop	32MB/192MB	2.38GB	12X	2MB ATI 3D RAGE II	-	\$1549.64	84249
Equium 5230D	233MHz Pentium MMX	desktop	32MB/192MB	3GB	24X Max	2MB ATI 3D RAGE II+	-	\$1798.36	95209
Equium 6230D	233MHz Pentium II	desktop	32MB/192MB	3GB	24X Max	2MB ATI 3D RAGE II+	-	\$2199.43	95208
Equium 6260M	266MHz Pentium II	mini-tower	32MB/256MB	3.73GB	16X	4MB ATI 3D RAGE II+	-	\$2569.07	93106
Infra 7230	233MHz Pentium MMX	mini-tower	64MB/128MB	6.4GB	24X	2MB ATI RAGE II	56K bps	\$2009.26	96270
Infra 7231	233MHz Pentium MMX	mini-tower	64MB/128MB	4GB	DVD	2MB ATI RAGE II	56K bps	\$2495.58	96269
Infra 7260	266MHz Pentium II	mini-tower	64MB/128MB	6.4GB	24X	2MB ATI RAGE II	56K bps	\$2599.47	96582



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Astra 610S

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- Maximum scan area: 8.5" x 11"
- Scanning modes: 30-bit color, 10-bit grayscale

\$168.84 CDW 98034

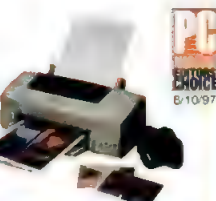


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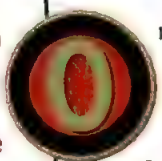


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the Best PCs for '97 & '98

By Cade Metz

With the maturation of desktop management, the business PC marketplace has clearly segmented into two lines: managed corporate PCs and power-driven professional/enthusiast systems.



Once upon a time, PC buyers merely chose among manufacturers. Now you must sift through a list of business-PC sub-genres: the traditional standalone PC, the managed PC, the professional (individual or enthusiast) PC, and possibly the NetPC, the NC, and the workstation.

This report, our traditional fall roundup of business machines, has been restructured to reflect the fragmented market. Excluding, for now, the narrower NetPC, NC, and workstation genres, we focus on the two most prominent and pertinent classifications. These we call the managed corporate PC and the professional enthusiast PC.

The managed corporate PC is designed for corporate installations where a small group of administrators maintains a large and diffuse network of machines. This type of PC must be easy to inventory and monitor from a remote console, and easy to service when upgrades or repairs are required. By giving network administrators greater control over a client machine, so the theory goes, corporations can reduce that machine's TCO (total cost of ownership)—the acronym of the moment in an industry defined by acronyms.

The professional enthusiast PC, designed for individual, SOHO (small-office/home-office), or networked power users, is built for speed rather than for manageability. Equipped with the newest PC core technology and the latest mainstream multimedia peripherals, such PCs are suitable for critical business applications as well as graphics manipula-

all new



Benchmarks

PHOTOGRAPHS BY THOM D'CONADOR

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PROFESSIONAL PCS

Do you need power and the latest cutting-edge technology from your PC? PC Labs tested 52 professional/enthusiast Microsoft Windows 95-based systems using Pentium II, AMD K6, or Cyrix 6x86MX processors. The power these systems offer is also surprisingly affordable.

MANAGED CORPORATE PCS

Here are 18 high-end Windows NT systems with Pentium II and AMD K6/233 CPUs and 27 more mainstream Windows 95 PCs using Pentium MMX or K6/200 processors—all packed with tools for controlling costs and tracking your network assets locally and remotely.

CHOOSING THE RIGHT PC FOR YOU

This pullout section has pointers on what to look for in a professional/enthusiast PC, a managed corporate PC, and a home PC. You'll find a worksheet for each type of system with recommendations and space for you to fill in your own choices.



Professional/Enthusiast

■ Professional/enthusiast PCs are meant for power users and offer the latest technology—from Pentium II CPUs to AGP to Ultra ATA hard disks.

■ AGP is intended to speed up 3-D graphics, but just the wider 66-MHz bus (versus PCI's 33 MHz) will net you some performance benefits across the board.

■ These PCs are multimedia-ready, with top-notch sound and 24X CD-ROM drives. High-capacity DVD drives are also starting to make an appearance.

■ DMI 2.0 compliance is the key to well-managed PCs. The spec adds standardized remote procedure calls (RPC), for greater remote manageability.

Managed Corporate

■ The best managed PCs offer full system-inventory data both locally and remotely, hardware monitoring, wake-on-LAN, and remote BIOS upgrades.

■ Easy-to-service chassis are a must. Tool-free cases, neatly designed interiors, and accessible components lower servicing time and out costs.



Vendor Service and Reliability

We rate vendors for which we received at least 50 responses in our latest Service and Reliability Survey of 17,000 subscribers. For details, see our July 1997 issue, page 184. The **reliability** ranking is a measure of satisfaction with the reliability of the vendor's desktops in use over the past two years. The **repair** and **tech support** rankings are measures of satisfaction with the vendor's repair service and support, respectively, for desktops in use over the past two years. **Units needing repair** refers to the proportion of desktops that the respondents said needed repair during the past 12 months. Here, "significantly better than average" means the incidence of needed repairs was lower than average.

- Significantly better than average
- Average
- Significantly worse than average

	Satisfaction with			Units needing repair over the past 12 months
	Reliability	Repair	Tech support	
Acer/Altos	○	○	●	○
Compaq	●	○	●	●
Dell	●	●	●	●
Digital	●	○	●	○
DTK	○	○	○	●
Everex	●	○	○	○
Gateway	●	●	●	○
Hewlett-Packard	●	●	●	○
IBM	●	●	●	●
Micron	●	●	●	○
NEC	○	○	○	○
Quantex	●	●	○	●
Toshiba	●	○	○	○

tion, Internet browsing, and high-end gaming. Only the home PC, which is less dependent on raw calculation speed, offers a higher level of multimedia performance. We will examine home PCs in our next issue (December 16, 1997).

We review 97 PCs: 45 managed PCs (divided into high-end and mainstream subgroups) and 52 professional PCs; 60 leading manufacturers are represented. AST Computer and MidWest Micro declined participation; each was between product revisions as our testing began.

MANAGED PCs: REVIEW CRITERIA

Under our managed PC classification, high-end systems run Microsoft Windows NT and mainstream systems run Microsoft Windows 95. To accommodate Windows NT, each high-end unit contains a CPU optimized for 32-bit code (the Pentium II/266, the Pentium II/233, or the AMD K6/233), 64MB of RAM, and a graphics adapter with at least 4MB of memory. Each mainstream machine running Windows 95 contains a midrange CPU (a Pentium MMX of any speed, a Cyrix 6x86MX of any speed, or an AMD K6/200), 32MB of system RAM, and 2MB of graphics memory.

In both categories, units are equipped with a 3GB or larger IDE hard disk, a 15-inch monitor or larger, a CD-ROM drive, a 10/100-Mbps Ethernet adapter, and a

DMI (Desktop Management Interface) solution providing management capabilities over the LAN.

DESKTOP MANAGEMENT INTERFACE

DMI, a specification developed by a consortium of industry leaders known as the DMTF (Desktop Management Task Force), is essentially a means of examining a machine's components and monitoring its health without opening it. A complete DMI solution has five basic levels of implementation: a management application, a management interface, a service layer (also known as a service provider), a component interface, and an ASIC (application-specific integrated circuit) capable of flagging high temperatures, irregular voltages, fan failures, and chassis intrusions.

The service layer is a standard piece of code defined by the DMTF. Loaded during start-up, the service layer collects system information from the component interface (which has culled data directly from various hardware and software components, including the ASIC) and stores that information in a MIF (management information file) database. The management application, after talking to the service layer and the MIF database via the management interface, then reports all gathered DMI data using a convenient GUI. Such applications can run either on

a remote console or on the client itself.

Though each managed PC we reviewed ships with a DMI solution, the effectiveness of the solutions varies from system to system. Most machines (30 out of 45) used Intel's LANDesk Client Manager 3.0, a management application licensed to PC manufacturers by Intel. Though this package is compliant only with the DMI 1.1 spec (the DMTF finalized Version 2.0 earlier this year), it can—if well implemented—provide a competent set of inventory and monitoring features. Many vendors, however, put little effort into their implementations and thus afford little in the way of true PC management.

LANDesk Client Manager 3.1, compliant with DMI 2.0, is much easier for manufacturers to implement (and therefore more adept, on the whole), but its availability was limited during our testing period. Only three vendors—Acer America, Gateway 2000, and Micron Electronics—shipped working Version 3.1 solutions with their systems. By the end of the year, this revision should be ubiquitous.

As would be expected, the most adept DMI solutions come from a select group of the industry's leading vendors. Whereas IBM augments LANDesk with an adjunct package known as the LAN-Client Control Manager, four other manufacturers—Compaq, Dell, Digital,

Our Contributors: CADE METZ is a staff writer at *PC Magazine*. ROBERT S. ANTHONY is senior staff writer, and MARY E. BEHR and MELISSA J. PERENSON are staff editors of *PC Magazine*. BRUCE BROWN and WINN L. ROSCH are contributing editors of *PC Magazine*, and JON A. HILL and FRANK J. EVANS are frequent contributors to *PC Magazine*; PATRICK NORTON is a freelance writer. ANUSH YEGYAZARIAN was the associate editor in charge of the story, and S. JAE YANG was the project leader.

and Hewlett-Packard—have developed their own management applications from scratch. These packages adhere to the DMI 2.0 spec and, in some cases, offer extra features as well. (For more on DMI and management applications, see the sidebar “Applied DMI: Solutions and Pitfalls.”)

SERVICEABILITY

Though equipped with DMI solutions, many of this roundup’s managed PCs lack accessible motherboards and easy-to-service chassis designs—two features any corporate administrator should demand. Only 19 of the 45 PCs have tool-free cases, and only three PCs use Intel’s new NLX form factor (a low-lying desktop whose motherboard is easily removed). PCs with user-friendly architectures can significantly reduce TCO (if it takes less time to service a machine, then you need fewer administrators), but you’ll have to go to the household names—Compaq, Dell, Digital, IBM, NEC, and the rest—to find them.

PROFESSIONAL PCs: REVIEW CRITERIA

The 52 systems grouped into our professional PC category use the same sixth-generation CPUs as our high-end managed PCs (the Pentium II/266, the Pentium II/233, and the AMD K6/233), but each is equipped with 32MB rather than 64MB of memory and preloaded with Windows 95 rather than Windows NT. Windows 95—which offers Plug and Play capabilities and, in its OSR-2.1 revision, support for the new AGP (Advanced Graphics Port) standard—is still the best option for power users desiring high-end multimedia.

AGP was not a necessity for inclusion in this category, but each machine was required to have a graphics adapter with 4MB of memory and to support 1,024-by-768 resolution with 24-bit color. Other minimum requirements included a 3GB or larger IDE hard disk, a CD-ROM or DVD drive, and an audio adapter.

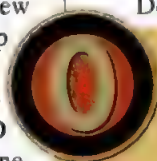
ADVANCED GRAPHICS PORT

AGP, which debuted this fall along with Intel’s 440LX chip set, has introduced a new era for graphics subsystems. With AGP, graphics engines benefit from a 66-MHz connection to the system bus (as opposed to the 33-MHz connection of

typical PCI graphics solutions) and, in some cases, a direct path to main memory. The latter, utilized during high-end 3-D rendering, is operational only in the presence of three key pieces of software: Windows 95 OSR 2.1, Microsoft’s DirectX 5.0 multimedia programming interface, and Intel’s AGP driver (VGARTD.VXD).

Though 13 of the professional PCs reviewed here include AGP cards, only 2 implement AGP correctly; 5 shipped to us with OSR 2 rather than OSR 2.1, and 6 others failed to include VGARTD.VXD. All 13 use AGP’s 66-MHz system bus, but only the Dell and Mega PCs benefit from AGP’s direct path to main memory.

Dell’s machine performed very well



OUT OF 13 PCs THAT USE
AGP CARDS, ONLY 2 IN
THE PROFESSIONAL/ENTHUSIAST
GROUP HAVE IMPLEMENTED
AGP CORRECTLY.

during 3D WinBench 98 testing, but Mega’s system scored poorly because Mega implemented the graphics card driver improperly.

That said, today’s applications rarely take full advantage of AGP. If AGP is properly implemented, you may see improvements in heavy 3-D texture mapping and a bit of a performance boost in 2-D applications (we saw a 5 percent increase, on the average, in Business Winstone 98 scores). Until mainstream applications coded specifically for AGP become prevalent, a typical PCI graphics card is still a viable option. Equipped with 8MB of memory, such a card can even match AGP’s 3-D texture-mapping performance.

We also noticed a distinct pattern in 3D WinMark results: Most graphics cards that did well in 2-D testing did poorly in 3-D, and vice versa. Only systems with the Number Nine Revolution card seemed fairly adept at both 2-D and 3-D work.

SDRAM AND ULTRA ATA

The 440LX is also the first P6 (Pentium Pro or Pentium II) chip set to support SDRAM (synchronous DRAM) memo-

ry, for faster data streaming between the CPU and I/O devices, and Ultra ATA, for faster IDE hard disk transfer rates. Of the 17 professional PCs that use the LX chip set (the 13 machines with AGP cards plus 4 other Pentium IIs), 16 used SDRAM and 9 had Ultra ATA hard disks.

DVD

DVD, the heir apparent to the CD-ROM, is used by eight of this review’s professional PCs. Current DVDs are the same size and shape of standard CD-ROMs, but they offer seven times the storage capacity. Each 4.7GB disk can store a full-length feature film.

Movie DVDs, which can also be read by the standalone consumer-market DVD player that connects to your TV set, are catching on and could challenge VCRs as playback devices. In addition to reading such disks, the DVD systems here are backward-compatible with audio CDs and standard CD-ROMs. Eventually, DVD will be the predominant medium for interactive PC games, edutainment software, and film. Intel predicts that DVD software sales will reach \$4.6 billion by the year 2000.

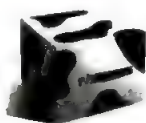
THE UPSHOT

As is often the case with the business PC market, the genre promises more than it consistently delivers in well-implemented technology. Oft-repeated acronyms such as AGP, DMI, DVD, NLX, SDRAM, and Ultra ATA are all available in some cases, but none are ubiquitous and few have met their full potential. Managed PCs are not always well managed, and professional PCs aren’t always worthy of the professional.

The state of the PC, however, is perpetually improving. Microsoft’s PC97 specification, a 378-page tome that 1997 machines must satisfy in order to receive a Windows certification logo, has begun to enhance and unify the market. Of the 97 machines reviewed here, only 11 lacked USB (one of the PC97 requirements). Only 4 used the aging Baby AT form factor (motherboard form factor is another spec). With the arrival of PC98—defined by Microsoft, Intel, and Compaq—more systems will incorporate AGP and other faster system buses (66- or 100-MHz). And with PC99, we should finally see the end of ISA. The market is never where everyone would like it to be, but it is always getting closer.



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PROFESSIONAL/ENTHUSIAST PCs



ower users, whether in a business or individual environment, are the intended audience for these 52 Windows 95-based systems. We asked each vendor for a machine with an Intel Pentium II or AMD K6 CPU, 32MB of RAM, a 3GB or larger hard disk, and a 17-inch monitor.

Many of these systems also feature

fast 3-D graphics cards, DVD drives, Ultra ATA hard disks, three-piece sound systems, and the latest Intel 440LX chip set, which supports the Accelerated Graphics Port (AGP) for faster and more cost-effective graphics.

You won't need to break the bank either: You can purchase a basic Pentium II-based system for as little as \$2,000 or an AMD K6-based system for \$1,700.



- Dell Dimension XPS D266
- NEC Direction SPL266

Two Pentium II/266-based systems, the Dell Dimension XPS D266 and the NEC Direction SPL266, emerged

from this competitive field of professional/enthusiast PCs to earn our Editors' Choice.

At \$2,649, Dell's XPS D266 is a terrific all-around value, featuring SDRAM, a 7.8GB IBM Ultra ATA hard disk, and Intel's new 440LX chip set, which supports AGP. Dell was also the only one of the 52 vendors in this roundup to configure AGP properly to work right out of the box, providing all three of the needed pieces and correct drives. The XPS D266 delivered competitive performance on most of our tests, with standout Business Disk WinMark 98 results. Thanks to the nVidia RIVA 128 graphics chip set, the XPS D266 also earned the best 3-D scores in this roundup.

The Dell unit also comes with FM and wavetable-synthesis sound, Altec Lansing ACS290 speakers, and Microsoft Office 97 Small Business Edition, Encarta 97, or Bookshelf. Dell covers its system with 24-hour, 7-day toll-free technical support and a three-year-parts, one-year-labor warranty. Dell was also one of two vendors to earn top honors on our 1997 Service and Reliability Survey.

The \$3,037 NEC Direction SPL266 is this roundup's performance champ. The system comes loaded with SDRAM, the

440LX chip set, a fast 6.2GB IBM Ultra ATA hard disk, and an 8MB Number Nine Revolution 3D AGP graphics card. This combination blazed through our tests and earned this roundup's top Business Winstone 98 score. The unit's Number Nine graphics card was one of the few that perform well on both the 2-D and 3-D sides of the fence.

NEC also bundles Microsoft Office 97, integrated Yamaha FM and wavetable audio, and Altec Lansing ACS45 speakers with the unit. The system is backed by a three-year warranty with one year of on-site service included and 24-hour, 7-day toll-free support.

Although there are Pentium II PCs in this roundup for as little as \$2,000, we found the CyberMax Max P6 PII-266 to have the best combination of price and performance, earning an honorable mention. For just \$2,499, you get a Pentium II/266-based system with a 17-inch monitor, SDRAM, the 440LX chip set, a Matrox Millennium II graphics card with 4MB of WRAM, and a 6GB IBM Ultra ATA hard disk, all of which add up to terrific performance. The system is covered for three years, with one year of on-site service. Toll-free technical support is available 24 hours, 7 days.

Professional PCs



AcerPower Minitower.

Aberdeen Power II

Pentium II/266, 4.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 19.9. \$2,999 direct.

The Aberdeen Power II is a fine deal, providing strong 2-D graphics performance at an average price.

Based on a SuperMicro motherboard with an Intel 440FX chip set, the Power II was an average performer on most of our benchmark tests. Its Matrox Mystique 220 graphics card with 4MB of SGRAM helped it achieve an above-average Business Graphics WinMark 98 score. Its 3D WinMark 98 score, however, was poor.

The system includes SuperMicro's PC Health Monitor card in a proprietary slot to monitor temperature and chassis intrusion for an added measure of security. You also get a U.S. Robotics 56.6-Kbps x2 modem and a Creative Labs Sound Blaster AWE64 audio card with the unit. The company uses a third-party supplier, NWC, for on-site coverage for the one-year warranty period.

The Aberdeen Power II is fairly priced and an average performer for its class.—*Bruce Brown*

Aberdeen LLC, Santa Fe Springs, CA; 800-552-6868, 562-801-5626; fax, 562-801-5629; www.aberdeeninc.com. *Circle 441 on reader service card.*

AcerPower Minitower

Pentium II/233, 3.1GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 16.9. \$2,530 street.

The AcerPower Minitower offers useful

hardware and software features for its target market of business power users, but it falls behind the pack in terms of performance.

The AcerPower yielded below-average Business Winstone 98 and Business Graphics WinMark 98 scores and was an average performer on our other tests. The unit's STB Nitro 3D graphics card with 4MB of DRAM and an S3 Virge/GX chip set also yielded a low 3D WinMark 98 score.

The unit comes in a lockable mini-tower case that is designed to be easily serviceable. Some components are easier to get to than others, however; for example, the system's 3.1GB Quantum hard disk is mounted on a cage that can be removed easily, but the memory slots are partially hidden under the unit's drive bays.

The unit is network-ready, featuring a 3Com 10/100 EtherLink XL Ethernet card (an \$85 option, included in the price above) and Intel's LANdesk Client Manager 3.1 software. The unit also comes with Lotus SmartSuite 97.

Acer provides a three-year parts-and-labor warranty with one year of free on-site service. Telephone technical support is available 24 hours, 7 days. The AcerPower Minitower offers a good design and network readiness, but performance is lacking.—*Robert S. Anthony*
Acer America Corp., San Jose, CA; 800-733-2237, 408-432-6200; www.acer.com. *Circle 442 on reader service card.*

ACMA EXP Pro 266

Pentium II/266, 3.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone score: 18.0. \$2,799 direct.

The ACMA EXP Pro 266 is a solid performer with an attractive price that includes an Iomega Zip drive.

The system earned mostly average scores on our benchmark tests. The EXP Pro's STB Nitro 3D graphics card gave the unit a low 3D WinMark 98 score.

The unit comes with a tool-free chassis, a nice touch. A U.S. Robotics 56.6-Kbps x2 modem, Creative Labs Sound Blaster AWE64 sound card with wave-table and FM synthesis, and four Qtech QX-SW32 speakers round out the hardware package.

The system has a three-year-parts,

one-year-labor warranty, which includes a year of on-site service. The company also offers a 45-day money-back guarantee. Technical support is available during business hours on weekdays.

ACMA's system offers competitive performance at an average price; the Iomega drive is a nice plus.—*Mary E. Behr*
ACMA Computer Corp., Fremont, CA; 800-578-1888, 510-623-1212; fax, 510-623-0818; www.acma.com. *Circle 443 on reader service card.*

Advanced Megatrends Apollo 266PII

Pentium II/266, 5.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.6. \$2,949 direct.

The Apollo 266PII midtower from Advanced Megatrends Microsystems Corp. features a high-end hard-disk subsystem and offers above-average graphics performance, good for the unit's target audience of graphics power users.

Thanks to a Matrox Millennium II graphics card with 4MB of WRAM, the 266PII earned an above-average Business Graphics WinMark 98 score. Its 3D WinMark 98 result was below average. All other test scores were average.

The 266PII uses a SuperMicro P6SKE motherboard that integrates a Slot 1 connector for its Pentium II/266 CPU as well as a Socket 8, which can be used for a Pentium Pro CPU.

Our test unit featured a Promise Ultra ATA IDE disk controller and a Quantum Ultra ATA hard disk, two USB ports, an internal Iomega 100MB Zip drive, and Microsoft Office 97 Professional Edition. No DMI software was included, but the motherboard offers DMI 2.0 support and has a user-specified temperature alert.

The company offers a three-year warranty on parts, one year on labor, with a year of free on-site service and 24-hour, 7-day technical support. With solid components and average performance, the Apollo 266PII holds its own as a professional PC.—*RSA*

Advanced Megatrends Microsystems Corp., Warwick, RI; 800-495-2955, 401-737-3859; fax, 401-737-3862; www.advancedmegatrends.com. *Circle 444 on reader service card.*

Professional PCs

All Computer Technology
P6II-266PT

Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.7. \$3,558 direct.

The All Computer Technology P6II-266PT aims to be both a professional and a corporate machine, bundling DVD and Zip drives, a 56.6-Kbps x2 modem, and a PCI Intel EtherExpress Pro 10/100 card. The P6II-266PT, a respectable performer, is packed with components that justify its higher-than-average price.

The unit offers good performance, with an above-average Business Graphics WinMark 98 score thanks to its Matrox Millennium II graphics card. This unit's 3D WinMark 98 score, however, was below average.

The system includes Microsoft Office 97 Professional and Intel's LANdesk Client Manager 3.0, as well as the LM78 ASIC for hardware monitoring. The Pioneer DVD drive lacked instructions for setting the monitor to 60 Hz to view video clips. This lack would make configuring the system difficult for a novice.

The P6II-266PT comes with a one-year warranty. Four years of on-site support is a \$229.98 option and includes 24-hour, 7-day toll-free technical support. Standard technical support is available only during business hours on weekdays.

The P6II-266PT is worth the price—but if you need lots of technical support, you'll have to pay extra or look elsewhere.—**BB**
All Computer Technology, City of Industry, CA; 800-775-1953, 626-369-4181; fax, 626-961-7462; www.allcomp.com. *Circle 445 on reader service card.*

AMAX GFX Pro 266

Pentium II/266, 3.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone: 20.7. \$3,050 direct.

The AMAX GFX Pro 266 from AMAX Engineering Corp. has great expandability, a subwoofer, and strong performance.

The Matrox Millennium II graphics card earned the unit an above-average Graphics WinMark 98 score but a poor 3-D WinMark 98 result. Other scores were within the average range.

Fitted with an Intel 440FX chip set, the GFX Pro 266 is rare among systems in this roundup in that it can handle up to 1GB of

SIMMs on its Tyan Computer motherboard. The roomy tower system also comes with a U.S. Robotics 56.6-Kbps x2 modem, FM and wavetable-synthesis audio, and Sound Image speakers with subwoofer.

AMAX offers a three-year-parts, one-year-labor warranty with one year's on-site service. Telephone technical support is offered only during business hours on weekdays, but the Web site has driver updates and other helpful information.

The GFX Pro 266 is a competitive performer with an average price.—**MEB**
AMAX Engineering Corp., Fremont, CA; 800-800-6328, 510-651-8886; fax, 510-651-4119; www.amax.com. *Circle 446 on reader service card.*

American Multisystems InfoGold
PIIM

Pentium II/266, 4.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98: 20.3. \$3,099 direct.

American Multisystems' roomy InfoGold PIIM is targeted at demanding professional users in medium-size corporations. It comes with a LAN card standard and a 56.6-Kbps x2 voice modem, and it provides above-average 2-D graphics performance at a competitive price.

The machine has an Intel 440FX chip set and a PCI Matrox Millennium II graphics card with 8MB of WRAM, which helped the unit achieve an above-average Business Graphics WinMark 98 score. The InfoGold PIIM earned a poor 3D WinMark 98 score. Its CD-ROM WinMark 98 score was above average; other scores were average.

The DMI 2.0-compliant unit comes with a 3Com PCI 10/100 network card and DMI Remote Control software, complete with the LM78 ASIC chip for hardware monitoring.

American Multisystems provides a one-year warranty; one year of on-site service costs \$99. Toll-free technical support is available for extended business hours weekdays; a paging service is available on Saturdays. The InfoGold PIIM is a good value for those looking for a network-ready professional PC.—**BB**

American Multisystems, Milpitas, CA; 800-888-6615, 408-945-2296; fax, 408-945-2299; www.infogold.com. *Circle 447 on reader service card.*

Compaq Deskpro 2000
6266X/3200/CDS

Pentium II/266, 3.1GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98: 19.8. \$3,280 street.
Good management tools, solid performance, and an attractive service offering mark Compaq Computer Corp.'s Deskpro 2000 6266X/3200/CDS.

The Deskpro 2000's test scores were mostly average, though its motherboard-integrated Matrox graphics chip set produced a low 3D WinMark 98 score.

The unit doesn't include a network card, but it has Compaq's enhanced Intelligent Manageability DMI management software. That means you have DMI support locally and can inventory the system as well as detect case intrusion via a chassis alarm. Compaq's own Netintelligent 56.6-Kbps modem is included.

Unlike with most of the other systems in the professional category, the Deskpro 2000's mini-tower case contains an NLX motherboard, which allows you to slide it out and replace it with a minimum of fuss. The riser card that carries all the ISA and PCI slots does block access to system memory, however. Though it uses the LX chip set and thus supports AGP, there is no AGP slot.

Compaq offers a three-year warranty on the system, which includes the first year of service on-site. Toll-free technical support is available 24 hours, 7 days. Solid performance and good support enhance the Deskpro 2000's appeal.—**Patrick Norton**
Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; fax, 281-518-1442; www.compaq.com.

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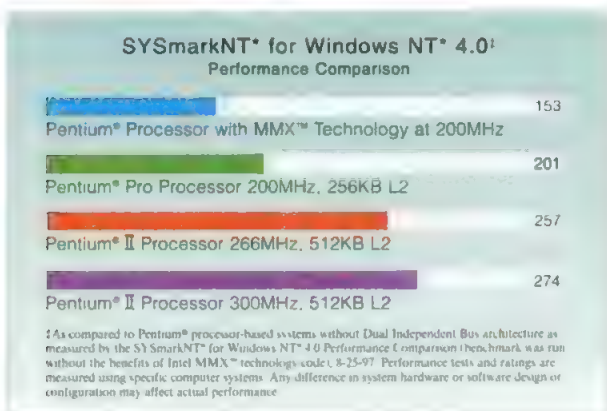
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Choosing the Right PC for You

Different PCs meet different needs. In the following pages, you'll find our recommended configurations for three distinct types of PCs: high-powered professional/enthusiast machines, managed corporate systems, and home PCs. We list our suggestions on worksheets so that you can compare our recommended specs with those of the machines you're considering.



Professional/Enthusiast PCs

If you're a power user looking for that last ounce of performance, professional/enthusiast PCs are for you, no matter whether you're in a small office/home office, hooked up to a network, or looking for a personal system. Fortunately, these days you don't have to break the bank to attain high performance levels. We saw basic systems going for as little as \$1,700 with a K6 processor and \$2,000 for a Pentium II/233 system; full-featured systems are selling for an average of \$2,750.

Performance champs in this year's group of professional/enthusiast systems used Pentium II/266 CPUs, SDRAM, Matrox Millennium II or Number Nine Revolution 3D graphics cards, and IBM's Deskstar Ultra ATA hard disks. With the right chip set (such as Intel's 440LX for the Pentium II or the 430TX for Pentium MMX-class CPUs), or a special disk controller, an Ultra ATA drive provides throughput of up to 33 MBps (versus 16.7 MBps for Fast ATA-2 drives). For 3-D-intensive tasks, choose a graphics card based on the new nVidia RIVA 128 chip set, such as Diamond's Viper V330 or STB's Velocity 128 3D.

Managed Corporate PCs

Managed corporate systems are meant to be enterprise-wide solutions; as such, they're designed with different priorities in mind than professional/enthusiast PCs. Manageability is key, and to achieve that, you need a system that can be inventoried remotely, that performs some self-monitoring and alerts you to problems, and that's easy to service when there is a problem or it's time to upgrade. Individual components aren't as important as these manageability features.

To make these features work, you need to

have the proper software and hardware support, which begins with DMI 2.0 compliance. The mainstream corporate systems we tested in this issue (based on Pentium MMX-class CPUs) varied in price from \$1,100 to \$2,699. High-end systems, based on Pentium II and AMD K6/233 processors, varied from \$2,349 to \$3,699. Don't be distracted by initial hardware costs; the true value of well-built managed systems becomes apparent in total cost of ownership (TCO), not the selling price. Intel LANdesk was the most popular desktop management software we saw, and when implemented well, it can be a good solution. Proprietary solutions, however, such as those offered by Compaq and Hewlett-Packard, generally provide a higher level of system detail and remote functionality.

Home PCs

Versatility is the key to home PCs. These systems must often serve the diverse needs of multiple family members, from kids who want a good multimedia system for education and gaming to adults who need a powerful machine to do work at home and take care of personal finances. And all family members these days have reasons to go on the Internet, so a fast modem is important. You'll also want to get a good software bundle that includes the right programs, such as finance software like Microsoft Money or Quicken, productivity packages like office suites, and games.

You'll also want some of the same high-performance components found in the professional/enthusiast PCs, as well as top-notch sound that supports both FM and wavetable synthesis (such as the Creative Labs Sound Blaster AWE64 card) and good speakers with a subwoofer. We'll test new home PCs in our next issue (December 16, 1997).

Home PCs



- ❶ **Processor and memory** An Intel Pentium II/266 offers great performance for a good price. Although 300-MHz models have come down in price, the performance benefit is not yet commensurate with the added cost. You'll also need at least 32MB of RAM (get SDRAM for added performance) and 512K of L2 cache.
- ❷ **Hard disk** With operating systems, Web browsers, and productivity software taking up so much space, a 3GB hard disk is the smallest you should consider. Get a 6GB disk if you can; you'll probably need the extra storage soon enough.
- ❸ **Monitor** A 17-inch monitor is only \$200 to \$300 more than a 15-inch model and eases eyestrain.
- ❹ **Graphics card** Get a 64- or 128-bit graphics card that supports AGP; it will help with both 2-D and 3-D graphics.
- ❺ **CD-ROM or DVD drive** We recommend a DVD drive. A DVD is the same size as a CD-ROM but offers seven times the storage capacity, which enables it to hold a full-length feature film. DVD drives read all the standard CD-ROMs and audio CDs. But keep in mind that DVD drives are slower than CD-ROM drives right now, and they can add as much as \$500 to the cost of the PC. Consider getting a data-backup solution, such as an Iomega Zip drive.
- ❻ **Sound** A 64-bit sound card with FM and wavetable synthesis is a must if you want rich sound. Pair it up with good speakers and a subwoofer.
- ❼ **Modem** We recommend a 56 Kbps modem, but remember to check with your ISP. There are two competing standards, K56flex and x2. Find out which one your ISP supports before you buy. If you decide to get a slower (33.6-Kbps) modem, make sure it can be upgraded.
- ❽ **Keyboard** Some vendors offer programmable keyboards, which give you one-touch access to the Internet, voice mail, or your favorite applications. If you plan to play lots of games, make sure to get a joystick or game pad.
- ❾ **Software** Well-rounded bundles include productivity software (such as office suites and financial software), as well as games and educational packages.
- ❿ **Warranty** Look for a system with at least a three-year parts-and-labor warranty that's supplemented by a year of on-site service. Round-the-clock telephone technical support is also important.

	OUR RECOMMENDATION	YOUR CHOICE
Price	\$3,300 or less	.....
Processor	Pentium II/266	.....
Memory	32MB of SDRAM	.....
L2 cache	512K pipelined-burst	.....
Hard disk	3GB IDE	.....
Monitor	17-inch	.....
Graphics card	128- or 64-bit AGP with 4MB of graphics memory	.....
MPEG support	Hardware or software (depending on needs)	.....
CD-ROM or DVD drive	DVD drive preferable, 24X (maximum) CD-ROM drive	.....
Sound	64-bit with FM and wavetable synthesis	.....
Speakers	2-piece, with subwoofer	.....
Modem	56.6-Kbps	.....
Operating system	Windows 95	.....
Software	Well-rounded bundle	.....
Warranty (parts/labor/on-site)	3 years/3 years/1 year	
Technical support	24 hours, 7 days	

Worksheet

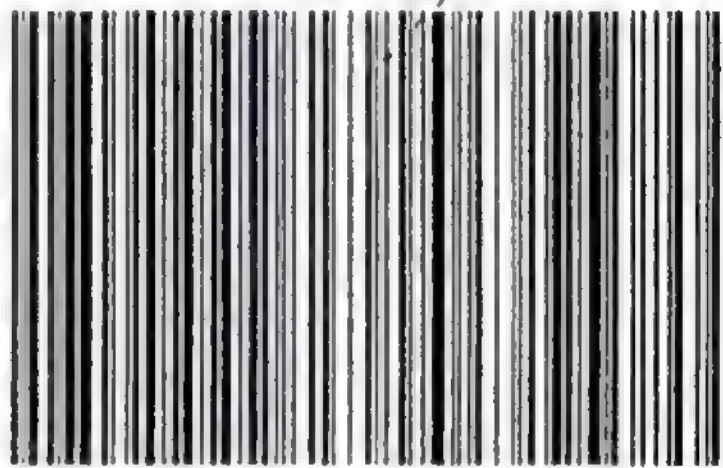
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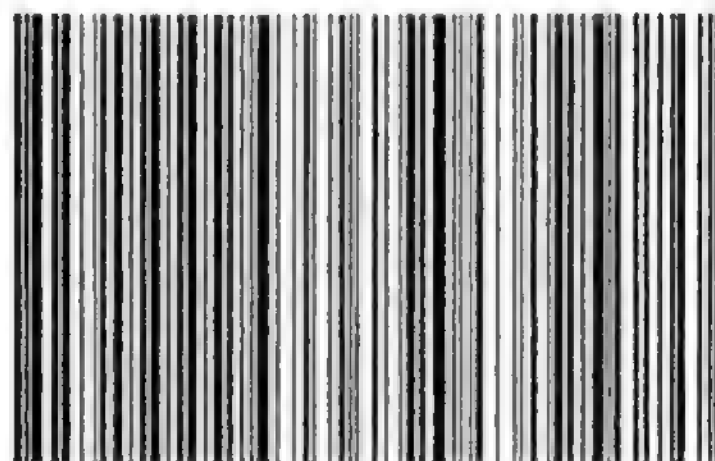
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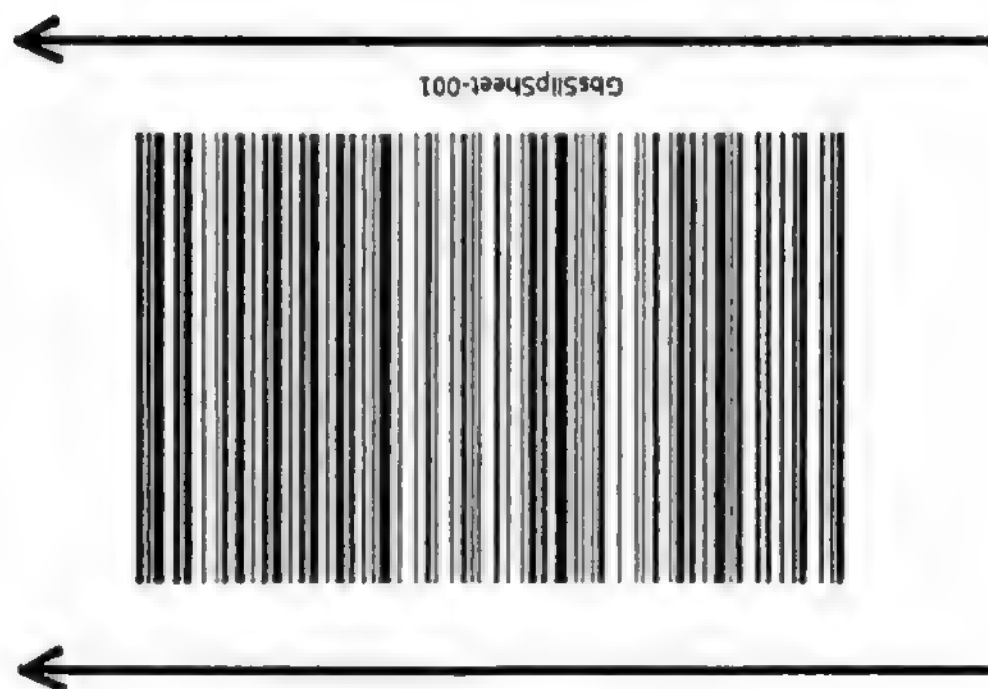
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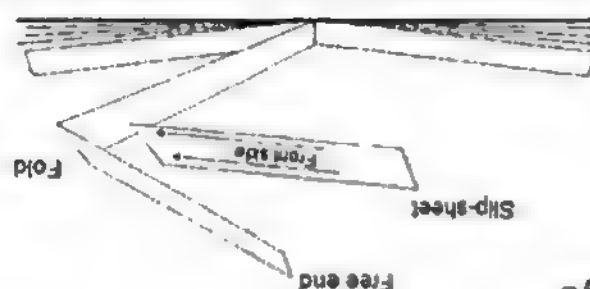
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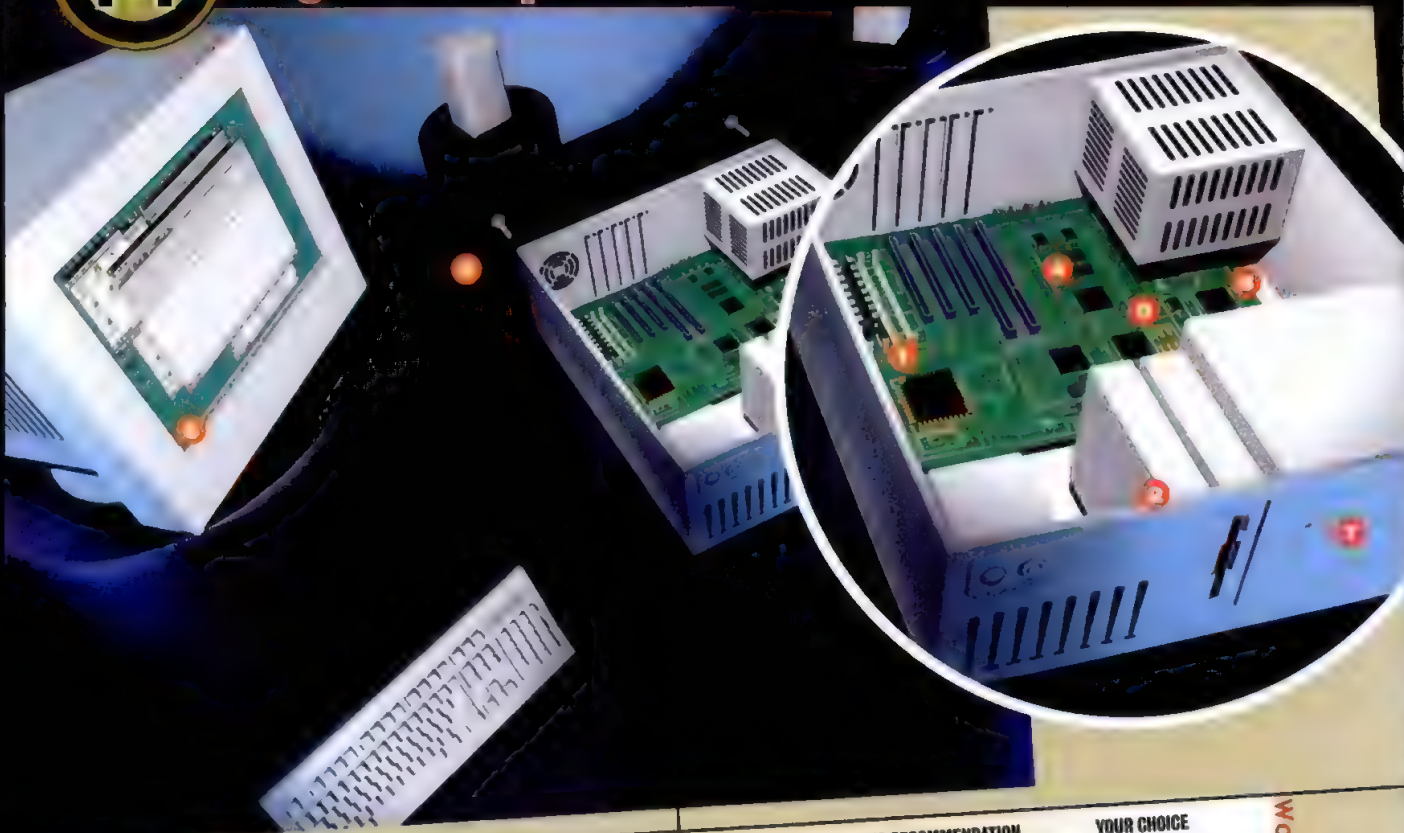
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Foldout slip-sheet

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1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



M_{anaged corporate PCs}



❶ **Processor and memory** An Intel Pentium MMX at either 200 MHz or 233 MHz will give you the performance you need for a good price. Consider AMD K6 and Cyrix 6x86MX alternatives if you want to save. We also recommend at least 32MB of RAM and 256K of L2 cache.

❷ **Hard disk** Storage is inexpensive enough to make a 4GB hard disk the smallest you should purchase.

❸ **Desktop management** Desktop Management Interface 2.0 compliance with good desktop management software (either a well-implemented version of Intel's LANDesk or a proprietary solution) is a must for today's true managed corporate PC. Check the implementation carefully: Not all systems provide the same level of information, and not all have such features as Wake-on-LAN, hardware monitoring of fan, temperature, and motherboard voltages; and chassis intrusion alarms. Some proprietary solutions also offer remote BIOS upgrades and other remote-management features.

❹ **Network card or integrated chip set** An auto-sensing 10- or 100-Mbps Ethernet controller is your best bet; you'll be able to handle current network conditions and future upgrades. Make sure the controller supports Wake-on-LAN.

❺ **Case** Whether you choose a standard desktop or a mini-tower, make sure that it has no-tools access (thumbscrews or latches) and that the interior is neatly laid out, with all components clear and accessible. Check the design for added ease-of-servicing features, such as an easy-to-remove motherboard. For security, get a case that can be locked.

❻ **Monitor** For standard tasks, a 15-inch monitor serves very well.

❼ **CD-ROM or DVD drive** For most work, we recommend a 20X CD-ROM drive; consider DVD at this time only if you require its high storage capacity.

❽ **Graphics** You'll get decent performance from a 64-bit graphics subsystem; 2MB of RAM should be plenty for most tasks. Consider an AGP graphics subsystem for added performance and cost-effective 3-D support.

❾ **Sound** For most office work, a 16-bit sound card (or integrated audio chip set) with FM synthesis and two speakers is adequate.

❿ **Warranty** Get at least a three-year-parts, one-year-labor warranty that's

	OUR RECOMMENDATION	YOUR CHOICE
Price	\$2,250 or less	.....
Processor	Pentium MMX/200 or Pentium MMX/233	.....
Memory	32MB	.....
L2 cache	256K pipelined- burst (minimum)	.....
Hard disk	4GB IDE	.....
Monitor	15-inch	.....
Graphics card	64-bit with 2MB of graphics memory (AGP optional)	.....
Network card	Auto-sensing 10/100-Mbps	.....
CD-ROM or DVD drive	20X (maximum) CD-ROM drive	.....
Sound	16-bit	.....
Speakers	2-piece	.....
Modem	56.6-Kbps (optional)	.....
Operating system	Windows 95	.....
Software	DMI management software	.....
Warranty (parts/ labor/on-site)	3 years/1 year/1 year	.....
Technical support	24 hours, 7 days	.....

Worksheet

supplemented by a year of on-site service. Make sure the vendor offers round-the-clock telephone technical support.

Professional/enthusiast PCs



1 Processor and memory An Intel Pentium II at either 233-MHz or 266-MHz speed offers great performance at a decent price; the difference in cost between the two versions is small enough that we recommend getting the 266-MHz model. 300-MHz versions have come down in price, but the performance benefit is not commensurate with the added cost. Augment this with at least 32MB of RAM (get SDRAM—synchronous DRAM—for an added performance boost) and 512K of L2 cache.

2 Hard disk A 3GB hard disk is the smallest you should consider; we recommend 6GB, which leaves you enough room to grow. For fast throughput, get an Ultra ATA IDE hard disk.

3 Monitor A 15-inch monitor is adequate if you have budget constraints, but a 17-inch monitor is only \$200 to \$300 more and eases eyestrain.

4 Modem It's natural to want the fastest and the best, and we do recommend buying a 56.6-Kbps modem. Be aware, however: There are two competing standards, K56flex and x2. Check with your ISP to see which it supports, or make sure that the modem you buy can be upgraded.

5 CD-ROM or DVD drive A DVD is the same size as a CD-ROM but offers seven times the storage capacity, which enables it to hold a full-length feature film. DVD drives read all the standard CD-ROMs and audio CDs. But DVD drives are slower than CD-ROM drives right now (8X to 10X for DVD, while CD-ROM drives are reaching a maximum speed of 24X); keep that in mind when you make your decision. Consider a removable media device, such as an Iomega Zip drive, for data backup or extra storage.

6 Graphics Make sure to get a 128- or 64-bit graphics card that supports AGP (Advanced Graphics Port) and 4MB of RAM to allow true color (24-bit or 32-bit). Although this port is designed to speed 3-D functions, you'll get some performance boost even in 2-D: AGP runs on a 66-MHz bus, which is considerably faster than PCI's 33-MHz connection. To make full use of AGP and its direct path to main memory, make sure you're running Windows 95 with OSR 2.1, DirectX5, and the VGARTD.VXD driver.

7 Sound A 32-bit sound card with FM synthesis and two speakers is the minimum to consider. Wavetable support is also recommended.

	OUR RECOMMENDATION	YOUR CHOICE
Processor	Pentium II/266	.....
Memory	32MB of SDRAM	.....
L2 cache	512K pipelined-burst	.....
Hard disk	6GB Ultra ATA	.....
Monitor	17-inch	.....
Graphics card	128- or 64-bit AGP with 4MB of graphics memory	.....
Network card	10/100-Mbps (optional)	.....
CD-ROM or DVD drive	24X maximum on the CD-ROM drive; DVD drive for heavy multimedia work	.....
Sound	32-bit with FM synthesis; wavetable optional	.....
Speakers	2-piece (subwoofer optional)	.....
Modem	56.6-Kbps	.....
Operating system	Windows 95	.....
Software	Office suite	.....
Warranty (parts/labor/on-site)	3 years/1 year/1 year	.....
Technical support	24 hours, 7 days	.....

8 Warranty If you have no MIS staff, look for a system with at least a three-year-parts, one-year-labor warranty that's supplemented by a year of on-site service. Round-the-clock telephone technical support and a Web site with a driver library are also helpful.

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chip set is the first to offer a 64-bit bus, in a system based on Intel architecture.
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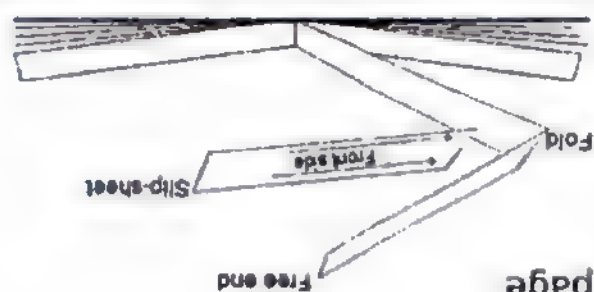


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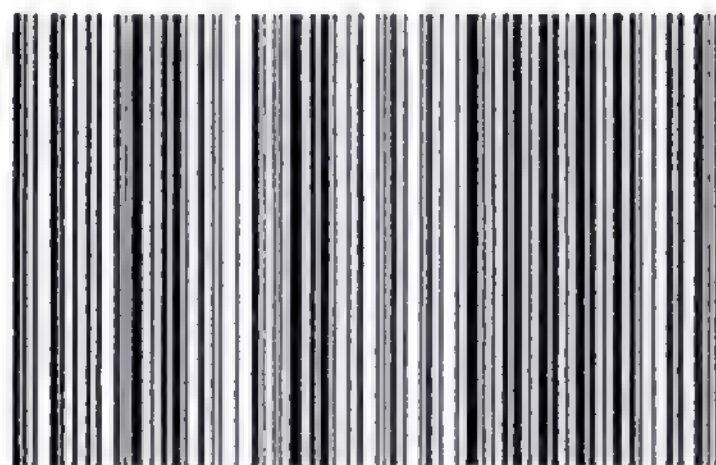
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Foldout slip-sheet

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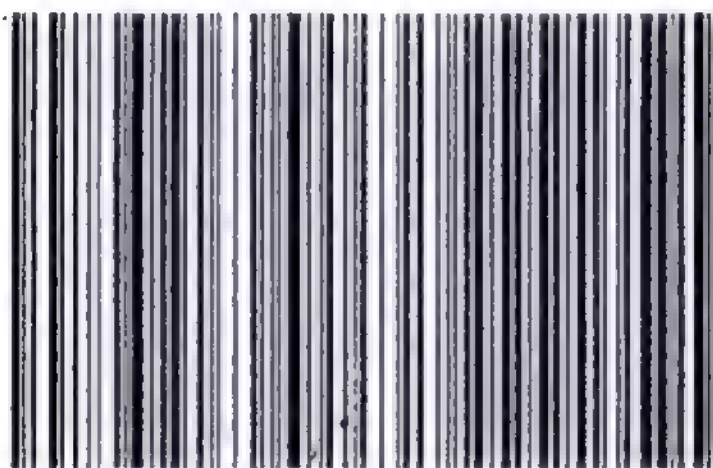
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It's official. The Micron™ Millennia XKU is the favorite of *PC Magazine* editors — and the envy of our competitors! If you're serious about computing, don't miss what *PC Magazine* calls a "standout performer" with "the ideal configuration for serious computing or 3D gaming."

Micron's Millennia XKU desktops deliver uncompromising power, speed and performance, wrapped up in stylish new cases. And they're built with Intel Pentium® II processors featuring MMX technology, a 440Lx chip set, standard Iomega Zip drive — and so much more!

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This cutting-edge notebook can do almost anything. It's the incomparable combination of power, components and portability that makes the TransPort XKE the notebook for the power user on the go."

With features like an Intel Pentium processor, a 20MB cache, MMX technology, standard personal voice recognition software, and Windows NT® Workstation pre-installed — this notebook is a true power user's choice.



MILLENNIA
XKU
Sept. 1997



TRANSPORT
XKE
Aug. 1997

Millennia Xku

STANDARD FEATURES

82440LX chip set
512KB internal L2 cache, 2MB BIOS
Integrated 100MB Iomega ZIP drive
3.5" floppy drive
24X variable speed EIDE CD-ROM drive
32 voice wavetable stereo sound with Advent 009 speakers and subwoofer
USR Sportster 56K x2 data/fax modem*
Diamond Viper V330 128-bit 3D video with 4MB SGRAM
Microsoft® IntelliMouse™, USB connections
Microsoft Windows® 95 and MS® Plus!
Microsoft Office 97 Small Business Edition
Choice of Micron Software Solutions Pak**
5-year/3 year Micron Power™ limited warranty

Millennia Xku 266

Intel 266MHz Pentium® II processor
(features MMX™ technology)
64MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,599

Bus. Lease \$89/mo.

Millennia Xku 300

Intel 300MHz Pentium® II processor
(features MMX™ technology)
128MB SDRAM
8.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$3,099

Bus. Lease \$106/mo.

Micron TransPort Xke

STANDARD FEATURES

512KB pipeline burst cache
128-bit, 2MB DRAM graphics
20X modular CD-ROM drive with AutoPlay™ technology
Pick-a-Point™ dual pointing devices
Microphone and 16-bit stereo sound
Integrated 33.6 Kbps modem, full duplex
Dragon Systems NaturallySpeaking Personal voice recognition software
CardBus- and zoomed video
2 infrared ports, S-video, NTSC, game, USB ports
Management and Executive Travel software pak
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Micron TransPort Xke 200

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3GB removable hard drive
13.3" TFT XGA display

\$4,899

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233MHz Intel Pentium processor
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48MB EDO RAM
3GB removable hard drive
13.3" TFT XGA display

\$5,249

Bus. Lease \$165/mo.

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Broderbund's Print Shop Ensemble III
Crayola's Magic 3D Coloring Book
Mindscape's Mavis Beacon Teaches Typing
Creative Multimedia's The Family Doctor

Quicken Financial Pak:

Quicken Deluxe
Parents' Guide to Money
Quicken Financial Planner
Quicken Family Lawyer

EdVenture Pak:

Comprised of exciting children's educational and entertainment titles. Call for current titles.

Arcade Pak:

X-wing v. Tie Fighter
Need For Speed 2
Command and Conquer Red Alert
Thrustmaster Game Pad

Powerdigm Xsu

STANDARD FEATURES

Supports IDE Ultra ATA and multiple Ultra-Wide SCSI-3 hard drives
Samurai™ chip set
Optional support for dual monitors
DMI, software and hardware management support
Iomega Jaz SCSI drive with 1GB removable cartridge
Wavetable stereo sound with speakers
3Com Fast EtherNet 10/100 PCI network adapter
Microsoft IntelliMouse
Microsoft Windows NT® Workstation
5-year/3-year Micron Power limited warranty

Dual Intel 300MHz Pentium II processors
64MB ECC DRAM
Memory upgradeable to 1GB ECC SDRAM
Fire GL 1000 pro 8MB 66MHz PCI Open GL Professional 3D accelerators
4GB Ultra-Wide SCSI-3 hard drive
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Price/performance index: professional/enthusiast PCs

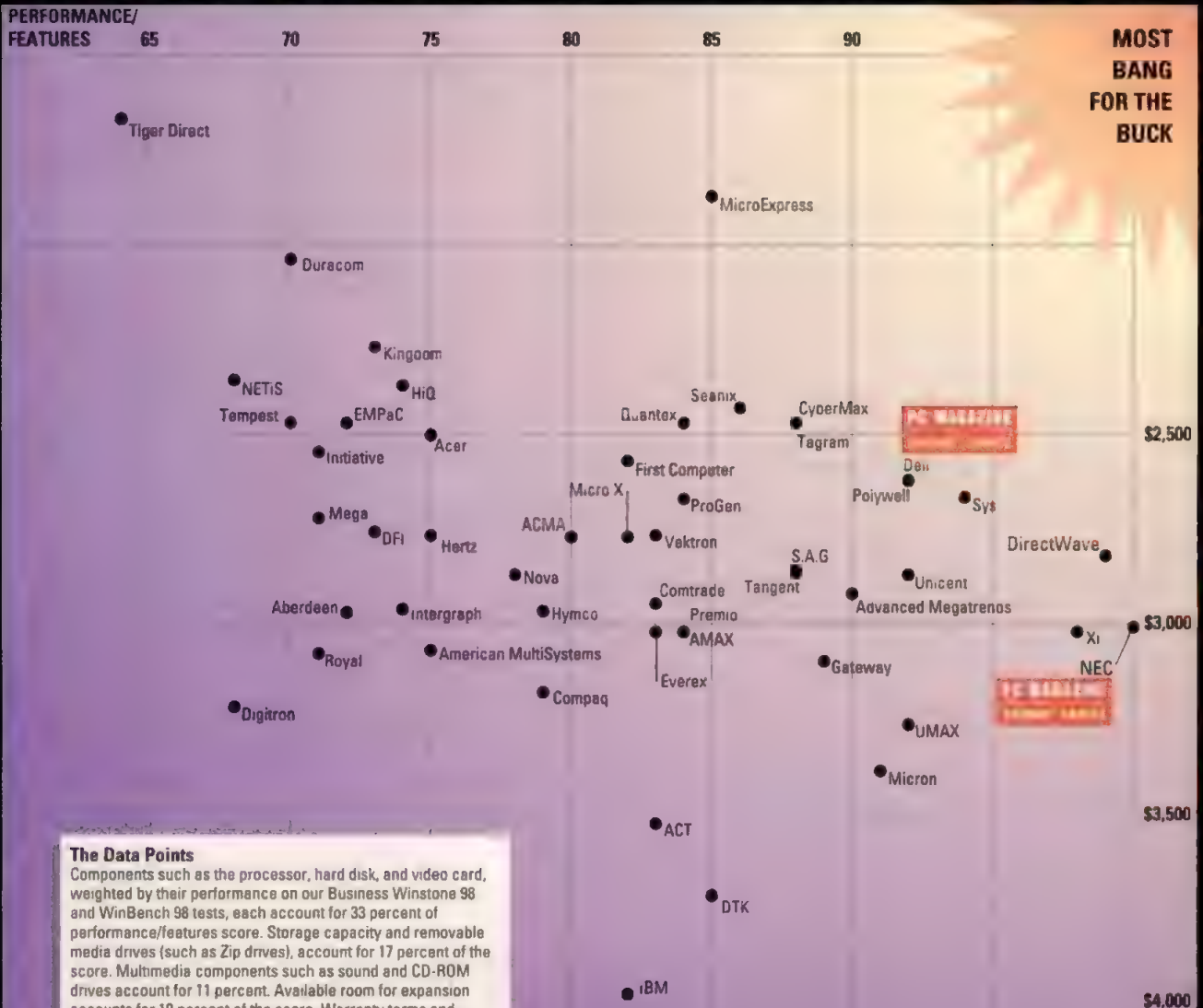
Boasting a Pentium II/266, AGP graphics from the Number Nine Revolution 3D card, an Ultra ATA hard disk, a great warranty, good sound, and some of this group's best performance on most of our tests, the \$3,037 NEC Direction SPL266, one of our Editors' Choices, earns this chart's highest performance/features score.

Both the CyberMax Max P6 PII-266

and the Tagram Thunderbolt New Generation VII, each \$2,499 direct, have a good balance of price, performance, and features. They garnered above-average scores on most of our tests, thanks to Pentium II/266 CPUs and Ultra ATA hard disks. The Tagram unit gets its graphics boost from its Number Nine Revolution 3D card, whereas the Max PC uses a Matrox Millennium II card.

CyberMax also offers round-the-clock technical support.

The MicroFlex-K6/Professional may not be a top performer, but at just \$1,899 it is a good bargain. It comes with an AMD K6/233 CPU and strong components, such as an Ultra ATA hard disk and a fast Toshiba CD-ROM drive, plus 24-hour, 7-day technical support and a four-year warranty.



The Data Points

Components such as the processor, hard disk, and video card, weighted by their performance on our Business Winstone 98 and WinBench 98 tests, each account for 33 percent of performance/features score. Storage capacity and removable media drives (such as Zip drives), account for 17 percent of the score. Multimedia components such as sound and CD-ROM drives account for 11 percent. Available room for expansion accounts for 10 percent of the score. Warranty terms and technical-support offerings, as well as additional features such as modem speed, make up the remaining portion of the score.

We could not calculate meaningful scores for the Magitronic and PC Channel/CTX, because these units could not complete all of our tests.

BENCHMARK TESTS

Professional/Enthusiast PCs



Top performers used the Pentium II/266, IBM Ultra ATA hard disk, and Number Nine Revolution 3D graphics card.

What the Numbers Mean

For this roundup, we employed the 1998 edition of our Ziff-Davis benchmark test programs. More challenging than ever, the new tests add such exercises as Web brows-

ing and task switching and update our existing tests. Our strategy is unchanged: We strive to achieve a system-level, single-score performance evaluation through ZD Business Winstone 98 and a component-level analysis using ZD WinBench 98 to rate each machine's graphics, disk, CPU, and CD-ROM subsystems.

ZD Business Winstone 98 Of the seven PCs that are significantly above average (10 percent or more above the mean) on this test suite, six have the Intel 440LX chip set (the S.A.G. Electronics unit uses the

440FX chip set). The top four systems—from NEC Computer Systems Division, Sys Technology, Tagram Systems Corp., and S.A.G. Electronics—have Number Nine Revolution-based graphics cards and IBM

Deskstar hard disks. The LX chip set supports the Ultra ATA interface, which allows a 33.3-MBps data transfer rate using the Ultra DMA protocol. The chip set also supports AGP, used by three of the four top performers on these tests. There is no 3-D application in Winstone, but the faster graphics bus (66 MHz for AGP versus 33



3-D application in Winstone, but the faster graphics bus (66 MHz for AGP versus 33

▲ High scores are best
▼ Low scores are best
Black bold type denotes first place
Red bold type denotes GDI bypassing.[†]
Aberdeen Power II

	ZD Business Winstone 98 Score	ZD Business Graphics WinMark 98 24-bit score	ZD Business Graphics WinMark 98 32-bit score	ZD Business Disk WinMark 98 Thousands of bytes per second
Aberdeen Power II	19.9	118	71	1,190
AcerPower Minitower	16.9	85	N/A*	1,170
ACMA EXP Pro 266	18.0	92	N/A*	1,220
Advanced Megatrends Apollo 266PII	18.6	118	73	1,200
All Computer Technology P6II-266PT	20.7	118	N/A*	1,330
AMAX GFX Pro 266	20.7	118	73	1,210
American Multisystems InfoGold PIIIM	20.3	119	N/A*	1,170
Compaq Deskpro 2000 6266X/3200/CDS	19.8	111	68	957
Comtrade Professional PC	19.1	N/A*	85	1,200
CyberMax Max P6 PII-266	21.1	124	N/A*	1,360
Dell Dimension XPS D266	20.1	N/A*	85	1,370
DFI Landmarq K6-233 Pro	17.1	97	64	1,120
Digitron HT3000	18.0	93	N/A*	1,240
DirectWave MVP VX2-266	21.4	131	113	1,200
DTK APR174M/K266	21.4	121	118	1,230
Duracom ProForma 1100	16.7	75	N/A*	805
EMPaC Velocity VII	16.3	60	N/A*	939
Everex StepStation 2 TGP	18.8	85	67	1,010
First Computer Systems Pentium II-266	19.3	102	64	1,210
Gateway GP-266	19.9	N/A*	88	1,240
Hertz II P266e	17.0	54	49	999
HiQ K6-233 PPC	16.4	76	66	1,110
Hymco HWS6266B	20.3	121	121	1,110
IBM PC300XL	20.5	119	N/A*	1,250
Initiative ITI-266P2	19.9	122	N/A*	996
Intergraph TD-225	19.8	104	71	1,110

(†) GDI bypassing inflates scores at the expense of compatibility with certain applications. (‡) With an Action, MPEG 1, 352-by-240, 30-fps, 300 KBps clip. (3) We tested at 32-bit color depth, because this unit does not support 24-bit color.

MHz for PCI) contributed to the high scores. Two of the six AMD K6/233-based PCs (those from Micro Express and DFI) outperformed the Pentium II/233 units on the strength of Ultra ATA disks, supported by the 430TX chip set.

ZD Business Graphics WinMark 98 To isolate the graphics subsystem speed properly, you should not compare Graphics WinMark 98 results across systems with different CPUs, since faster CPUs speed up graphics operations. This year, we tested systems with the display set to 24-bit or 32-bit color. If the system was capable of both color depths, we tested at both settings. The results show that systems tend to perform better at the 24-bit setting. Vendors including ATI and Matrox implement hardware-based "packed-pixel" data transfers in 24-bit mode, which allows

an additional byte of graphics data in each PCI-bus transfer. This improves performance over 32-bit mode. The average Graphics WinMark 98 score at 24-bit color was 16 percent higher than the average at the 32-bit setting.

The best Business Graphics WinMark 98 scores in this part of the roundup belong to systems with the Number Nine Revolution 3D, which displays true color in 32-bit mode only. This graphics card, based on the Tick-et2Ride chip set, comes with PCs from Sys Technology, Xi Computer Systems, NEC Computer Systems Division, and S.A.G. Electronics. The 32-bit setting offers no visual improvement over 24-bit because the additional 8 bits do not carry extra color information in normal operation.

The new, faster AGP 66-MHz bus proved to be of some help in 2-D graphics

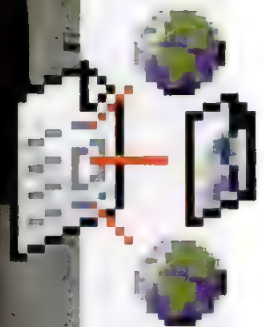
as well. In this part of the roundup, we saw Matrox Millennium II and Number Nine Revolution 3D cards in both AGP and PCI formats. In each case, the 66-MHz AGP variety outperformed the 33-MHz PCI-bus version by about 5 percent.

Again, we caught several systems bypassing the standard Microsoft GDI. Our informal testing showed that for most of the culprits, GDI bypassing nets on the average a meager 1 to 4 percent exaggeration of Graphics WinMark 98 results. Such "improvement" comes with the side effect of instability in running applications such as Symantec's pcAnywhere and standard whiteboard applications that pass GDI information between two PCs. In analyzing the data, we found that the inflation of graphics scores due to GDI bypassing failed to result in any measurable real-world benefits.

ZD 3D WinMark 98 Score	ZD CPUmark ₃₂ Score ▲	ZD CD-ROM WinMark 98 Score ▲	CD-ROM			Full-Screen Scaling ²	
			Access Time (milliseconds) ▼	CPU Utilization (percent) ▼	Transfer Rate Inside (thousands of bytes per second) ▲	CPU Utilization (percent) ▼	Maximum Frame Rate (frames per second) ▲
83	681	1,320	103	97	2,130	98	8.6
91	604	1,410	100	56	1,840	66	48.1
104	686	1,310	103	97	2,130	64	48.1
87	712	1,200	118	56	2,010	98	8.5
85	680	938	154	45	1,500	98	8.6
88	721	1,300	107	97	2,130	98	8.9
85	689	1,370	102	54	1,970	98	8.7
95	689	1,360	95	4	1,800	98	8.9
411	686	1,500	96	64	2,190	95	31.2
89	690	1,530	100	20	2,180	98	9.4
457	678	1,340	109	5	2,040	89	33.5
51	557	1,010	146	36	1,560	98	4.7
104	685	764	159	35	1,220	60	52.0
90	695	1,320	101	34	2,180	98	10.0
90	697	1,550	94	5	2,160	98	8.6
49	603	1,130	126	46	1,600	98	6.3
45	603	1,370	104	54	1,910	98	3.5
83	686	1,090	119	52	1,830	98	9.0
87	687	1,370	94	51	1,790	98	8.7
407	689	1,160	122	16	1,810	91	33.1
101	689	1,100	139	5	2,080	N/A**	N/A**
57	566	1,240	102	20	2,000	95	4.8
68	692	610	186	32	924	98	10.1
65	680	1,160	120	4	1,610	98	8.8
54	690	1,070	143	37	2,080	98	9.0
52	680	1,180	124	55	1,820	97	6.4

BETTER ▶

N/A*—Not applicable. This product does not support the tested color depth. N/A**—Not applicable. The product did not complete this test.



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Time: Friday, 8:30 a.m.

To: Communications

Re: Anyone there know how to build a Web site?

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BENCHMARK TESTS

as none of those systems register any significant gain on Business Winstone 98 scores.

ZD Business Disk WinMark 98 We tested systems with mainstream 5,400-rpm hard disks, not higher-performance, costlier (and noisier) 7,200- or 10,000-rpm SCSI hard disks. Building on the success of the previous generation of PCs with Ultra ATA IDE hard disks, the new breed of Ultra ATA disks dominate this roundup in number and performance. Of the 52 systems in this roundup, 34 boast Ultra ATA hard disks. These tests left no doubt as to who is king in the hard disk world. Systems with the IBM Ultra ATA Deskstar DHEA-364xx turned in the top eight scores on Business Disk WinMark 98. On the average, those scores are 17 percent above the mean.

ZD 3D WinMark 98 This test yielded discrete bands of 3-D performance. The top four systems, each scoring over 400, come with the Diamond Viper V330 or STB Velocity 128 3D video card; both use the AGP nVidia RIVA 128 chip set. The next band belongs to PCs with the Number Nine Revolution 3D, which earned scores of about 220. Scores below 100 indicate that rendering is done mostly in software, which translates into poor real-world performance.

Of the 13 systems with AGP cards, only the Dell Dimension XPS D266 and the Mega Impact Pentium II 266 AGP were properly configured to take advantage of AGP, providing all three key pieces AGP needs to function (DirectX 5.0, Microsoft Windows 95 with OSR 2.1, and the VGARTD.VXD driver). Because of the Impact Pentium II's improper driver

installation, however, the system saw no benefits from AGP or, for that matter, any of the graphics card's 3-D capabilities. The system, equipped with the ATI 3D Rage II chip set, is capable of a 3D WinMark 98 score over 100, but it scored only 52. AGP shows much promise for loading large textures from system memory, but we saw no PC in this roundup that uses AGP's sideband addressing.

We report results from 3D WinBench's 3D Quality test sorted by graphics cards in a special table online at www.pcmag.com.

ZD CPUmark₃₂ In the professional-system roundup, we see a clear division based on processors. The Pentium II/266 systems averaged a CPUmark₃₂ score of 688, the Pentium II/233s averaged 603, and the K6/233s averaged 554. The top three ma-

▲ High scores are best
▼ Low scores are best
Black bold type denotes first place
Red bold type denotes GDI bypassing.¹
Kingdom Pinnacle 266

	ZD Business Winstone 98 Score	ZD Business Graphics WinMark 98 24-bit score	ZD Business Graphics WinMark 98 32-bit score	ZD Business Disk WinMark 98 Thousands of bytes per second
Kingdom Pinnacle 266	19.0	87	N/A*	973
Magitronic G-P2266AGP	18.7	127	N/A*	872
Mega Impact Pentium II 266 AGP	19.9	95	N/A*	1,180
MicroFlex-K6/Professional	17.5	81	69	1,170
Micron Millennia XCD	19.9	N/A*	86	1,400
Micro X MXP-6100	20.7	138	130	1,160
NEC Director SP4266	22.0 ¹	N/A*	132	1,300
NETIS Starburst 266	15.9	104	77	1,010
Nova K6-233	18.7	75	60	1,130
PC Channel/CTX LAK233-32	15.9	85	57	1,130
Polywell 7266LX5	20.7	100	N/A*	1,220
Premio Apollo FX2 266	20.0	118	112	1,200
ProGen Polaris 266 W95	20.4	126	N/A*	1,210
Quantex QP6/266 SM-4X	20.2	121	N/A*	1,200
Royal Synergy Pro	18.3	90	N/A*	1,250
SAG PII 266	21.4	N/A*	130	1,250
Searx CS Power 266	20.1	122	112	1,210
Sys Performance Pro 266LA	21.7	N/A*	141	1,360
Tagram Thunderbolt New Generation VII	21.7 ¹	N/A*	138	1,360
Tangent Petra II 266	18.1	96	N/A*	1,190
Tempest 3D-128 Pro	20.3	115	123	1,140
Tiger AMD-K6 233 MMX	15.1	90	N/A*	830
UmaxStation 6000	18.1	90	90	1,060
Unicent Avanta 266XLP	18.8	123	N/A*	1,160
Vektron Vision2-266	20.6	126	117	1,240
Xi 532GP MTower	21.13	N/A*	135	1,230

(1) GDI bypassing inflates scores at the expense of compatibility with certain applications. (2) With an Action, MPEG-1, 352-by-240, 30-fps, 300-Kbps clip. (3) We tested at 32-bit color depth, because this unit does not support 24-bit color.

chines in CPUmark₃₂—from Micro X, AMAX Engineering Corp., and Advanced Megatrends Microsystems Corp.—employ the FX chip set, but there is no pattern in the data that indicates whether the FX or LX is conducive to better CPU performance. The LX chip set's benefits over the FX come from its support for performance-enhancing components such as Ultra ATA and AGP. Intel claims the LX chip set is also much better at managing concurrent transactions between CPU/memory, the graphics chip set (using AGP), and the PCI bus.

Full-Screen Scaling The systems using the Number Nine Revolution 3D, the Diamond Stealth 3D, the Hercules Dynamite 128, and the Matrox cards (Millennium, Millennium II, and Mystique) all had problems running our 300-KBps MPEG test clip. The Number

Nine was capable of only about 24 frames per second (fps), while the Diamond, Hercules, and Matrox cards couldn't play any better than 10 fps. In the case of the Millennium II, the card's 24-bit driver seems to be at fault because it played the clip acceptably at 32-bit color depth. Systems with other cards successfully played our test clip.—*Analysis written by S. Jae Yang*

How We Tested

We tested systems in two main categories: professional/enthusiast PCs (running Windows 95 with 32MB of RAM) and managed corporate PCs. We subdivided the managed corporate PCs into mainstream PCs, running Windows 95 with 32MB of RAM, and high-end systems, running Microsoft Windows NT 4.0 with 64MB of RAM. Each system had a 2.9GB hard disk or larger. We

stripped each system's startup configuration of all processes or tasks except for Systray and Explorer. For Windows NT 4.0 systems, we installed Service Pack 3, converted the file system to NTFS, and installed the TCP/IP stack required by the High-End Winstone 98 tests. For Windows 95 systems, we defragmented the hard disk before each test and let Windows 95 manage virtual-memory settings. We used the graphics driver provided by each vendor.

We used our new benchmark test program, **ZD Winstone 98**, to measure performance on 32-bit Windows applications. Winstone 98 is divided into two parts: **ZD Business Winstone 98**, focusing on mainstream applications, and **ZD High-End Winstone 98**, which emphasizes CPU and graphics-intensive applications. We ran our Business Winstone 98 tests, which measure

			CD-ROM			Full-Screen Scaling ²	
ZD 3D WinMark 98 Score	ZD CPUmark ₃₂ Score ▲	ZD CD-ROM WinMark 98 Score ▲	Access Time (milliseconds) ▼	CPU Utilization (percent) ▼	Transfer Rate: Inside (thousands of bytes per second) ▲	CPU Utilization (percent) ▼	Maximum Frame Rate (frames per second) ▲
54	691	730	332	4	1,900	79	7.8
N/A**	683	1,420	93	36	2,170	98	8.9
52	688	1,490	101	67	2,170	57	55.8
52	581	1,410	103	82	2,170	98	5.1
424	688	1,450	81	17	1,880	56	57.8
84	735	1,310	109	50	1,800	98	8.5
227	691	1,340	101	4	1,760	98	24.4
53	687	1,280	103	93	2,060	98	8.4
55	542	611	190	27	921	98	4.9
N/A**	544	1,270	110	19	1,800	83	38.2
101	695	1,360	97	15	1,880	47	68.6
84	677	1,090	143	59	2,080	98	8.1
88	690	1,020	140	14	1,530	98	9.3
83	685	1,510	98	62	2,180	98	8.7
118	688	861	141	35	1,220	57	56.7
220	684	1,220	104	96	2,140	98	23.4
69	685	1,490	97	62	2,160	98	8.4
228	694	1,370	103	10	2,010	97	24.4
227	690	1,340	90	16	1,790	97	24.0
103	686	1,390	99	53	1,930	58	54.4
87	691	1,360	94	5	1,790	98	8.7
52	535	1,210	182	48	1,930	97	4.7
53	689	1,360	94	53	1,790	98	6.5
89	686	885	136	11	1,220	98	9.8
86	676	1,560	85	61	2,090	98	11.5
208	692	1,250	104	17	2,010	98	23.9

BETTER ►

N/A**—Not applicable. This product does not support the tested color depth. N/A**—Not applicable. The product did not complete this test.

BENCHMARK TESTS

the time a PC takes to execute a set of scripts that exercise nine of the best-selling Windows 95 applications, on all the systems in this roundup. Business Winstone 98 weights a PC's test timings based on the applications' unit market shares; it derives a composite number and converts that to a relative score. (The score is relative to the performance of a Dell Dimension Pentium/133 with 32MB of RAM, at 1,024-by-768 resolution with 16-bit color, running Windows NT 4.0 with Service Pack 3. The base score is defined as 10.)

We ran our High-End Winstone 98 tests, which measure the time a PC takes to execute a set of application scripts that exercise seven Windows NT applications, only on the PCs in our high-end managed corporate subgroup. High-End Winstone 98 weights a given machine's seven timings equally, derives a composite number, and converts that to a relative score. (The score is relative to the performance of the base machine above, with the same base score of 10.)

ZD WinBench 98 measures a system's graphics, disk, processor, CD-ROM, full-motion video, and DirectDraw performance under Windows 95. Like our Winstone test program, ZD Graphics WinMark 98 and ZD Disk WinMark 98 are each divided into Business and High-End sections. We ran the Business portion of these suites on all systems and the High-End portion only on the high-end managed corporate PCs.

The **ZD Business Graphics WinMark 98** and **ZD High-End Graphics WinMark 98** scores are based on a log of GDI operations used in the Business and High-End Winstone tests, respectively. The Business Graphics WinMark score and the High-End Graphics WinMark score represent the performance of each machine's graphics subsystem under Windows 95 and Windows NT 4.0, respectively. Both test scores are normalized to reflect performance relative to the base system used for Winstone testing.

The **ZD Business Disk WinMark 98** and **ZD High-End Disk WinMark 98** scores are based on a log of disk functions used in the Business and High-End Winstone suites and represent the performance of each machine's disk subsystem under Windows 95 and Windows NT 4.0, respectively. We record the results in thousands of bytes per second and convert them to a harmonic mean. We then weight this mean in the same way as the Business and High-End

Winstone scores, respectively.

We used **ZD 3D WinBench 98** to evaluate 3-D graphics performance and to assess a system's ability to execute certain 3-D rendering features. We first perform the 3D Quality test to determine which of the 31 tested features the graphics card supports. We then run the performance portion of 3D WinBench 98 to obtain the **ZD 3D WinMark 98** score. The performance tests are made up of 19 scenes; each scene is rendered by hardware if the graphics card was found to support all the 3-D options in the scene based on the 3D Quality test. If not, the scene is rendered in software. On each system, we installed Direct3D 5.0 before running the tests; we ran the tests only on the professional/enthusiast group of PCs.

The **ZD CPUmark₃₂** score reflects the speed of a PC's processor subsystem, which includes the CPU, secondary cache, and system RAM, under 32-bit operating systems. CPUmark₃₂ emulates the CPU activity of real-world 32-bit applications. We ran this test on all systems.

The **ZD CD-ROM WinMark 98** test gauges the performance of each machine's CD-ROM subsystem, which includes the CD-ROM drive, adapter, and required software drivers. The test is based on a profile of today's most popular Windows CD-ROMs. The **CD-ROM Access Time** test measures performance as the drive randomly accesses 2K blocks from an entire CD-ROM. The **CD-ROM CPU Utilization** score represents the percentage of the CPU's bandwidth occupied by servicing the CD-ROM subsystem as it retrieves data. We also report the results of the **CD-ROM Transfer Rate: Inside** test, which measures the throughput of a CD-ROM subsystem reading the inside track of the CD-ROM, the minimal level of performance for the drive.

WinBench 98 also includes a suite of video tests that measure a PC's ability to play full-motion AVI files. These tests run a video clip with four different codecs: Cinepak, Indeo 3.2, Indeo 4.x, and MPEG. We tested all systems using MPEG only, through ActiveMovie control. We report results from the **Full-Screen Scaling** test, which uses an Action, MPEG-1, 352-by-240, 30-fps, 300-KBps clip. We report **CPU Utilization** and **Maximum Frame Rate**.

For more details, read "Inside PC Labs' Latest Benchmark Tests" in the PC Tech section of this issue.

Comtrade Professional PC

Pentium II/266, 6.2GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 19.1. \$2,975 direct.

Comtrade provides competitive performance—especially for those interested in 3-D—at an appealing price with the Professional PC. Although the system seems geared more to the home because of its many bundled games and entertainment CDs, it's also ready for the office: The bundle includes Lotus SmartSuite 97.

The system earned average scores on most of our tests, but it excelled at 3-D thanks to the nVidia chip set on its Diamond Viper V330 AGP graphics card. The nVidia is one of the best chip sets on the market, supporting most 3-D functions, but it is not as fast at more standard business functions; the unit had a below-average Graphics WinMark 98 score.

The Comtrade tower unit is easy to service; everything is easily accessible. The audio is on-board, and the SSI speakers with subwoofer are adequate. The U.S. Robotics 56.6-Kbps modem and a 24X CD-ROM drive add to the unit's appeal.

On-site service for one year is \$25. Technical support runs 7:00 to 7:00 Pacific time weekdays and 8:00 to 5:00 Saturdays; you can also download the latest drivers from the vendor's Web site. If you're looking for a 3-D-ready system that will also serve your business and budget needs, consider this Comtrade unit. —Frank J. Evans

Comtrade, City of Industry, CA; 800-969-2123, 626-961-6688; fax, 626-369-1479; www.comtrade.com. Circle 449 on reader service card.

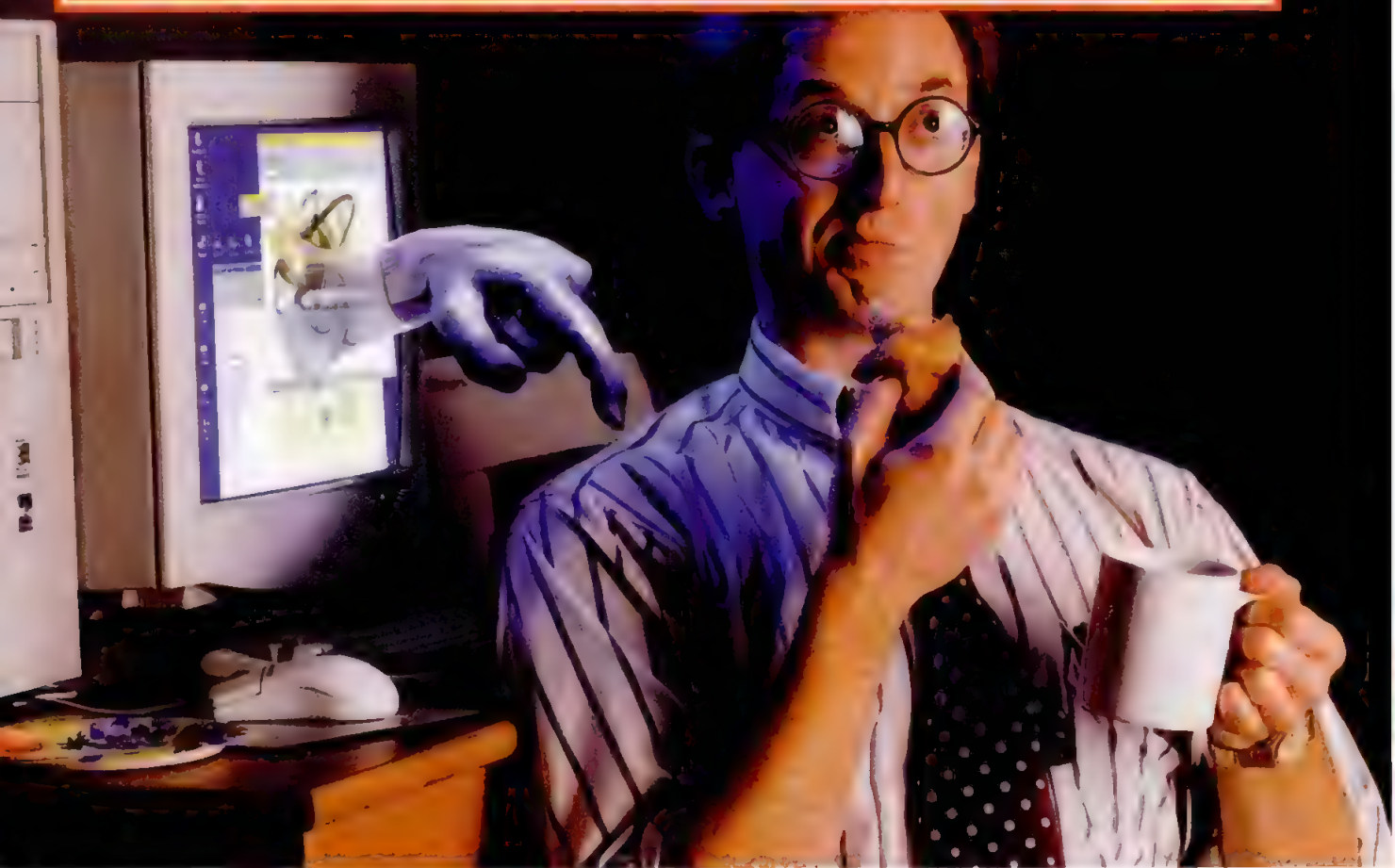
CyberMax Max P6 PII-266

Pentium II/266, 6.2GB disk, 17-inch monitor, SDRAM. Business Winstone score: 21.1. \$2,499 direct.

CyberMax Computer positions the Max P6 PII-266 as a high-end business system, and the unit delivers the above-average performance that such users demand. That and good warranty coverage make this system a steal.

The PII-266 posted above-average scores on many of our tests. Components such as SDRAM memory, 512K of secondary cache, an IBM Ultra ATA hard disk, and the new Intel 440LX chip set

Wouldn't it be great to have a full-time
tech expert in your PC, alerting you to
possible problems before they happen?
(Comforting thought, isn't it?)



Quantex has always built its machines to last, and backed them up with award winning tech support, second to none. Now, working hand in hand with Intel and utilizing their LANdesk® Client Manager Technology (LDCM), we've taken "support" to new heights. LDCM, a technology designed to monitor your PC's health and provide early warnings of potential PC problems, was originally developed for large businesses. Quantex now makes this technology available in a user-friendly format for individual and small business users.

LDCM automatically loads each time your PC is turned on, and runs in the background while you work. It continuously checks on the condition of your computer, and sends you a visual warning upon recognizing potential problems. A simple click of the mouse will inform you of a number of possible solutions to consider. If additional assistance is required, a system analysis print out can be sent to a Quantex technician to facilitate a quick resolution.

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It's great to know Quantex

The competition can't measure up to our award-winning systems.

Recently, our multimedia systems were awarded some of the industry's highest honors by *PC World* (11/97). Our QP5/200 SM-1 won praise as a "Best Buy", and was bestowed the number three spot in the Budget Desktop category. And, in the the Power Desktop category, our featured system, the QP6/266 SM-4x, achieved an honorable number six ranking. No surprise - it combines the biggest picture (19" Digital Monitor), the fastest CPU (300MHz Pentium® II processor), the largest hard drive (8.4GB EIDE), and the most stunning graphics available (128-bit Riva 128 3D AGP Card), all for less than you'd ever thought possible.



QP6/300 SM-4x **\$2999**

(featuring Pentium® II processor)

Business lease: \$105/Mo.

- 300MHz Pentium® II Processor
 - Intel 440LX PCI Chipset
 - 64MB SDRAM Memory / 512KB Secondary Cache
 - 8.4GB EIDE Mode 4 HD / 3.5" 1.44MB Floppy Drive
 - 128-bit Riva 128 3D AGP Graphics Card with 4MB SGRAM
 - Upgrade to AGP Matrox Millennium II 3D w/8MB WRAM for only \$149
 - 19" Digital Monitor (18.1" viewable)
 - Altec Lansing ACS-45 Speakers w/subwoofer
 - Includes all Standard Features
 - Quantex PC Health Monitoring & Support based on LDCM
- QP6/233 SM-4x (featuring Pentium® II processor) **\$2699**
 QP6/266 SM-4x (featuring Pentium® II processor) **\$2799**

QP6/300 SM-4x SE **\$3199**

(featuring Pentium® II processor)

Business lease: \$104/Mo.

- 300MHz Pentium® II Processor
 - Intel 440LX PCI Chipset
 - 64MB SDRAM Memory / 512KB Secondary Cache
 - 8.4GB EIDE Mode 4 HD / 3.5" 1.44MB Floppy Drive
 - 128-bit Riva 128 3D AGP Graphics Card with 4MB SGRAM
 - 19" Digital Monitor (18.1" viewable)
 - Toshiba 2nd-Generation DVD-ROM Drive
 - DVD Decoder Board
 - Altec Lansing ACS-490 Speakers w/subwoofer
 - Includes all Standard Features
 - Quantex PC Health Monitoring & Support based on LDCM
- QP6/233 SM-4x SE (featuring Pentium® II processor) **\$2899**
 QP6/266 SM-4x SE (featuring Pentium® II processor) **\$2999**

Power Multimedia Series

QP5/233 SM-1 **\$1599**

(with MMX™ Technology)

Business lease: \$56/Mo.

- 233MHz Pentium® Processor with MMX™ Technology
 - 32MB EDO Memory / 512KB Pipeline Burst Cache
 - 3.2GB EIDE Mode 4 HD / 3.5" 1.44MB Floppy Drive
 - STB Nitro 3D with 4MB
 - 15" Digital Monitor (14.0" viewable)
 - Altec Lansing ACS-90 Speakers
 - Quantex PC Health Monitoring & Support based on LDCM
- QP5/200 SM-1 (with MMX™ Technology) . . . **\$1499**
 QP6/233 SM-1x (featuring Pentium® II processor) **\$1799**
 QP6/266 SM-1x (featuring Pentium® II processor) **\$1899**

SOFTWARE BUNDLE

- MS Office '97 SBE ■ MS Money '97 ■ Office Mate ■ Day Planner Pro ■ Power Business Plans ■ Form Designer Pro ■ Project Manager Pro ■ Labels Unlimited
- Compton's Reference Collection ■ Dr. Solomons Anti-Virus ■ Windows 95 with MS Plus ■ One-month trial memberships to AOL, CompuServe and Prodigy

UPGRADES ■ Panasonic PD/CD-Rom Drive w/ one 650MB PD cartridge \$ 249 ■ Microsoft Natural Keyboard (upgrade from 104-keyboard) \$ 39 ■ HP Deskjet 692C Printer (w/photo color kit) \$ 299

Standard Features ■ 2 Universal Serial Bus (USB) Ports ■ K56flex™ protocol Fax/Modem w/Voice Mail and Speakerphone

- 24X Max EIDE CD-ROM Drive ■ Ensoniq 32-Bit Wavetable Sound Card ■ 104-Key Keyboard With MS IntelliMouse ■ MS Windows '95 With MS Plus ■ Power Multimedia Software Bundle (Including MS Office '97 SBE) ■ 3-year limited warranty, 24-hr./7-day Technical Support
- Quantex Tower Case

QP6/233 SM-2x **\$2049**

(featuring Pentium® II processor)

Business lease: \$72/Mo.

- 233MHz Pentium® II Processor
 - 32MB EDO Memory / 512KB Secondary Cache
 - 4.3GB EIDE Mode 4 HD / 3.5" 1.44MB Floppy Drive
 - STB Nitro 3D with 4MB
 - 17" Digital Monitor (16.1" viewable)
 - Altec Lansing ACS-90 Speakers
 - Quantex PC Health Monitoring & Support based on LDCM
 - Upgrade SM-2 to 64MB EDO RAM and 5.1GB HD for only \$150
- QP5/200 SM-2 (with MMX™ Technology) . . . **\$1749**
 QP5/233 SM-2 (with MMX™ Technology) . . . **\$1849**
 QP6/266 SM-2x (featuring Pentium® II processor) **\$2149**

QP6/266 SM-3x **\$2349**

(featuring Pentium® II processor)

Business lease: \$82/Mo.

- 266MHz Pentium® II Processor
 - Intel 440LX PCI Chipset
 - 32MB SDRAM Memory / 512KB Secondary Cache
 - 8.4GB EIDE Mode 4 HD / 3.5" 1.44MB Floppy Drive
 - 128-bit Riva 128 3D AGP Graphics Card with 4MB SGRAM
 - Upgrade to AGP Millennium II 3D w/4MB WRAM for only \$49
 - 17" Digital Monitor (16.1" viewable)
 - Altec Lansing ACS-45 Speakers w/subwoofer
 - Quantex PC Health Monitoring & Support based on LDCM
- QP6/233 SM-3x (featuring Pentium® II processor) **\$2199**
 QP6/300 SM-3x (featuring Pentium® II processor) **\$2549**

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Windows Sources "Power User's Bargain" (11/97)

"All in all, Quantex's H-Series is an excellent entry into the power-user segment of the notebook market...it offers the best deal we've seen on a 13.3-inch XGA screen."

PC Magazine "Honorable Mention" (10/07/97)

"...a great choice if you want a 233MHz (Pentium® processor with MMX™ technology) notebook but don't want to break the bank in the process"

C-Net Snapshot "Buy It" (09/17/97)

"Quantex makes an impressive debut in the laptop market with a value-priced portable that offers great features and performance."

"...users should definitely give the Quantex H-Series 1330 and the value it offers a serious look. We did, and that's why it gets a Buy It."



Quantex H-Series Notebooks do not include LDCM support

Quantex H Series

Quantex H 1331 \$4299

Business lease: \$140/Mo.

- 233MHz Pentium® Processor with MMX™ Technology
- Intel Mobile Module (I.M.M.) Architecture
- 13.3" XGA Active Matrix Display
- 64MB SDRAM (expandable to 144MB) / 512KB Pipelined Burst Cache
- 4GB HD / 3.5" 1.44MB Modular Floppy Drive
- PCMCIA K56flex™ protocol Fax/Modem
- 20X Max Modular CD-ROM Drive
- PCI Bus with 128-bit graphics accelerator
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- USB and Fast IR Ports
- Integrated Personal Touchpad
- MS Windows '95
- MS Office '97 SBE
- Carrying Case
- 24-hr./7-day Technical Support
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components



Standard Features ■ 3.5" 1.44 Modular Floppy Drive

- 20X Max Modular CD-ROM Drive ■ PCI Bus w/128-bit graphics accelerator
- Integrated 16-bit Stereo Sound and Speakers ■ Touchpad
- Smart Lithium Ion Battery ■ USB and Fast IR Ports

Quantex H 1211 \$3299

Business lease: \$107/Mo.

- 233MHz Pentium® Processor with MMX™ Technology
- Intel Mobile Module (I.M.M.) Architecture
- 12.1" SVGA Active Matrix Display
- 32MB SDRAM (expandable to 144MB)/512KB Pipelined Burst Cache
- 2GB HD
- PCMCIA K56flex protocol Fax/Modem
- Windows 95
- Carrying Case

Quantex H 1330 \$3899

Business lease: \$127/Mo.

- 233MHz Pentium® Processor with MMX™ Technology
- Intel Mobile Module (I.M.M.) Architecture
- 13.3" XGA Active Matrix Display
- 32MB SDRAM (expandable to 144MB)/512KB Pipelined Burst Cache
- 3GB HD
- PCMCIA K56flex protocol Fax/Modem
- Windows 95
- Carrying Case

SUPPORT POLICY

- 30-day money back guarantee ■ One-year Parts and Labor limited warranty ■ 3 years limited warranty on CPU and Main Memory ■ 1-year Depot Repair ■ 1-year express Replacement limited warranty ■ 24-hr./7-day Toll Free Technical Support

OPTIONS ■ Mini-Docking Station....\$199 ■ 2nd Lithium Ion Battery....\$199 ■ PCMCIA Network Adapter....\$129

- Deluxe Carrying Case....\$99

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Professional PCs



DFI Landmarq K6-233 Pro

contributed to the unit's great performance. The system earned a poor 3D WinMark 98 score.

CyberMax offers three years of parts-and-labor coverage and one year of on-site service. Toll-free technical support is available 24 hours, 7 days. If you don't need lots of 3-D capabilities, the comprehensive coverage combined with great performance and components (including a 56.6-Kbps K56flex modem from CPI) makes the PII-266 a tough system to beat.—**MEB CyberMax Computer Inc.**, Allentown, PA; 888-486-1212, 610-770-1808; fax, 800-599-7576; www.cybmax.com. *Circle 450 on reader service card.*

Dell Dimension XPS D266



Pentium II/266, 7.8GB hard disk, 17-inch monitor, SDRAM. Business Winstone score: 20.1. \$2,649 direct. Dell Computer Corp.'s Dimension XPS D266, one of our Editors' Choice winners, incorporates state-of-the-art components in a carefully designed system. The result is a strong performer that is a pleasure to use and maintain.

Start with the SDRAM-based memory subsystem. Dell pairs it with an AGP version of nVidia's RIVA 128 graphics chip to deliver the best 3-D performance in this roundup. The graphics card is relatively slow on standard 2-D operations, however, and produced a below-average Graphics WinMark 98 result. The large Ultra ATA IBM hard disk delivered above-average Disk WinMark 98 results. Other scores were average.

The XPS D266 has a nice design touch:

An oversize, Dell-designed heat sink projects beyond the Pentium II module, directly into the flow of a cooling fan, assuring that heat buildup is effectively removed from the entire case. The DMI 2.0-compliant XPS D266 does short you on available ISA slots; none are free. Both ISA slots are filled, one with a Sound Blaster AWE64, the other with a 56.6-Kbps x2 U.S. Robotics modem. With three open PCI slots, however, the unit is still expandable.

Dell rounds out the XPS D266 with a good software bundle: Microsoft Office 97 Small Business Edition, Encarta 97 or Bookshelf, and Automap 1997. You also get a robust service agreement: 7-day, 24-hour toll-free hardware support and a three-year-parts, one-year-labor warranty that is not restricted to the original owner.

The XPS D266 is thoughtfully designed, combining quality components and an affordable price.—**John A. Hill Dell Computer Corp.**, Round Rock, TX; 800-388-8542, 512-338-4400; fax, 512-832-4329; www.dell.com. *Circle 451 on reader service card.*

DFI Landmarq K6-233 Pro

AMD K6/233, 2.9GB hard disk, 17-inch monitor, DRAM. Business Winstone 98 score: 17.1. \$2,790 street.

DFI markets the Landmarq K6-233 Pro with an eye toward corporate and graphics users, specifically those in desktop publishing and document imaging. This unit has some strong multimedia components, including a Pioneer DVD-101 drive and a RealMagic Hollywood MPEG-2 Playback board, and offered competitive performance on most of our tests. You may find a better value in other systems, however.

In a roundup with most systems using Pentium II CPUs, it's not surprising that the K6-233 Pro, based on a K6 CPU, earned a below-average Winstone 98 score. The unit's Matrox Mystique graphics card with 4MB of SGRAM gave the unit a poor 3D WinMark 98 result.

The system features an Ultra ATA Quantum Fireball ST hard disk and a U.S. Robotics 56.6-Kbps x2 voice modem. The pair of ALI MidiLand speakers produced adequate sound.

DFI provides a two-year warranty with one year of on-site service for \$49. Technical support is available during business hours on weekdays. This unit may have

some appeal to SOHO users; high-end graphics users may prefer a unit with greater-capacity components.—**Melissa J. Perenson**

DFI Inc., Sacramento, CA; 800-808-4334, 916-568-1234; fax, 916-568-1233; www.dfiusa.com. *Circle 452 on reader service card.*

Digitron HT3000

Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.0. \$3,249 list.

Digitron Micro Solution's Digitron HT3000 combines high-end DVD multimedia hardware with adequate performance. Though it has home-oriented speakers, the HT3000 also holds its own as a solid professional PC.

The HT3000 posted average scores on nearly all our tests, except for a below-average CD-ROM WinMark 98 score because of the unit's Toshiba DVD drive, which plays standard CDs at 9X. The HT3000's 3D WinMark 98 score was also low.

The midtower unit was configured with an STB Nitro 3D graphics adapter with 4MB of DRAM, a 33.6-Kbps voice modem (upgradable to 56.6-Kbps x2), and a Cirque Input Center keyboard, which includes a touch pad that can capture signatures via a stylus (standard). The system also offers a DVD drive and an impressive SSI MT-100 Surround Sound Home Theater speaker system, which includes five speakers and a subwoofer. Lotus SmartSuite 97 and Compton's Encyclopedia are also included.

The vendor provides a one-year warranty and technical support during business hours weekdays. Four years of on-site service costs \$230. The speaker system may not be appropriate for an office cube, but those looking for competitive performance and a good multimedia package should consider the HT3000.—**RSA**

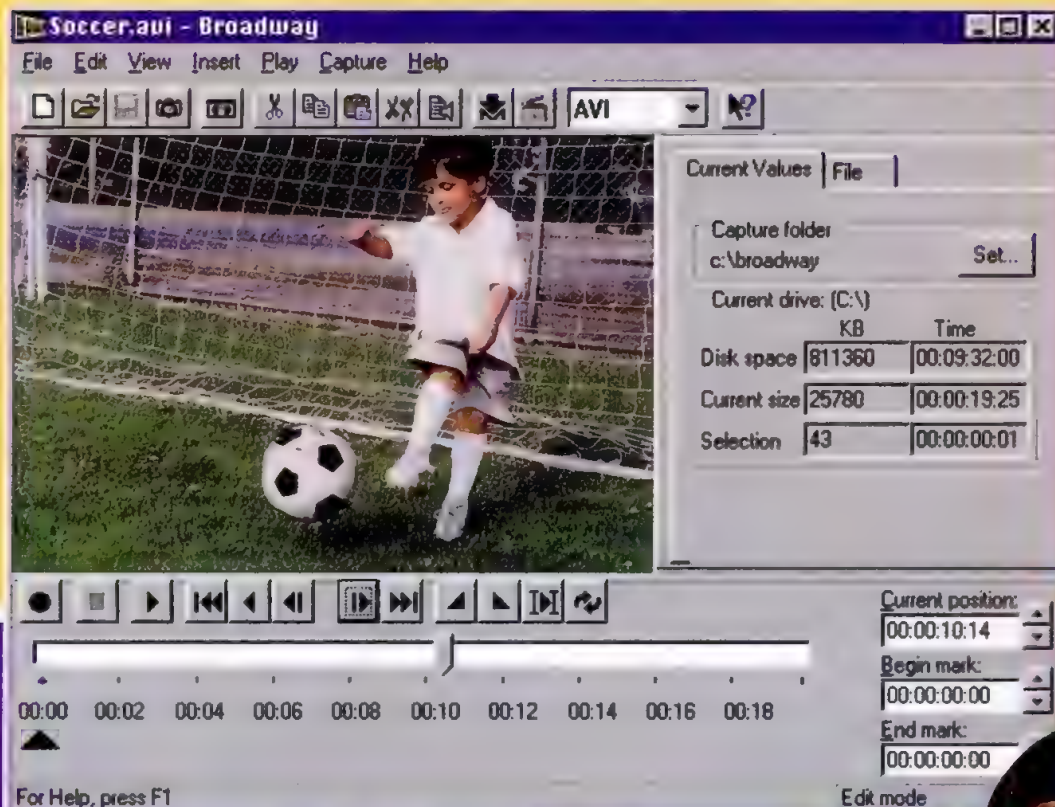
Digitron Micro Solution Inc., City of Industry, CA; 888-708-2800, 626-913-6136; fax, 626-913-9768; www.digitronpc.com. *Circle 453 on reader service card.*

DirectWave MVP VX2-266

Pentium II/266, 6.4GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 21.4. \$2,849 direct.

With admirable performance and a good feature set, the DirectWave MVP VX2-

WOW! Even I can do that.



Chris W. from Boston took several video clips from her son's soccer games and edited them into a single video with exciting effects and music.

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EDITOR'S CHOICE

WINNER

WINNER

WINNER

WINNER

266 midtower is a solid choice as a general-purpose professional PC. DirectWave targets desktop publishers and others in the high-end corporate market with the unit.

As one of only a handful of machines here with a cutting-edge AGP graphics system—featuring the Matrox Millennium II AGP card with 8MB of WRAM—the unit logged one of the best Business Graphics WinMark 98 scores in this roundup. The system had a poor 3D WinMark 98 result. The MVP VX2-266's Business Winstone 98 score was above average, and its other test scores were average.

The system includes a 56.6-Kbps K56flex voice modem and an OR Technology LS-120 floppy disk drive, which reads 120MB disks and standard 3.5-inch floppy disks. The ASUSTek ATX-style motherboard is DMI 2.0-compliant. DirectWave includes Intel's LANDesk 3.0 Client Manager.

DirectWave offers a 30-day, money-back guarantee, a three-year warranty, one year of on-site service, and one year of 24-hour technical support. Top performance and quality components make the MVP VX2-266 a good choice.—RSA

DirectWave Inc., Orange, CA; 800-882-8108, 714-978-9283; fax, 714-978-7363; www.directwave.com. *Circle 454 on reader service card.*

DTK APRI 74M/K266

Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone score: 20.4. \$3,560 street.

DTK positions the DTK APRI 74M/K266 as a high-end corporate system. The 74M/K266 fills the bill fairly well, posting average to above-average scores on most of our tests, but the price is higher than most.

SUMMARY OF FEATURES

Professional PCs

Price of tested configuration For PCs sold through resellers, assume that street prices will be 15 to 20 percent lower than list prices. Some vendors factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price. All street prices are rounded to the nearest \$10. Some vendors sell directly to customers. In those cases, we list the prices as *direct*; such prices are not discounted. Prices include the monitors.

Installed RAM type Synchronous DRAM (SDRAM) offers a performance advantage over extended data out (EDO) DRAM, because the access to SDRAM is synchronized to the CPU's clock in order to minimize wasted clock cycles.

Hard disk interface Fast ATA supports PIO mode 3 and multiword DMA mode 1 and has a maximum burst transfer rate of 13.3 MBps. Fast ATA-2 drives support up to PIO mode 4 and multiword DMA mode 2 and have a maximum burst transfer rate of 16.7 MBps. ATA-3 drives offer enhanced features such as plug-and-play, with the same maximum throughput as Fast ATA-2 drives. Ultra ATA drives comply with the Ultra DMA specification, which supports a burst throughput of up to 33.3 MBps.

Graphics adapter interface Accelerated Graphics Port (AGP) is a high-speed point-to-point connection between the system chip set and the graphics chip. Graphics cards that use AGP can access system memory directly through the system chip set at memory-bus speeds, which are faster than standard PCI connections. AGP also provides a cost-effective way for graphics subsystems to access large amounts of memory for fast 3-D rendering. Most graphics subsystems still go through the PCI bus, either through an adapter card or through integrated chip sets.

CD-ROM or DVD drive speed and model CD-ROM speeds are given as ranges, from minimum to maximum. For each DVD drive we list a single speed.

USB ports Designed to recognize peripherals instantly (Plug and Play), the Universal Serial Bus can accommodate up to 63 devices such as phones, modems, printers, and mice. The technology has been around a while, but the peripherals for it have been slow to market.

■ YES ■ NO

Products listed in alphabetical order:

	Aberdeen Power II	AcerPower Minitorner	ACMA EXP Pro 266	Advanced Megatrends Apollo 266PII
Price of tested configuration	\$2,999 direct	\$2,530 street	\$2,799 direct	\$2,949 direct
Processor	Intel Pentium II/266	Intel Pentium II/233	Intel Pentium II/266	Intel Pentium II/266
Installed RAM type	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM
Hard disk	Maxtor 85120A6	Quantum Fireball ST	Quantum Fireball ST	Quantum Fireball ST
Capacity and interface	4.9GB Ultra ATA	3.1GB Ultra ATA	3.9GB Ultra ATA	5.9GB Ultra ATA
Graphics adapter (interface)	Matrox Mystique (PCI)	STB Nitro 3D (PCI)	STB Nitro 3D (PCI)	Matrox Millennium II (PCI)
Memory	4MB SGRAM	4MB DRAM	4MB DRAM	4MB WRAM
Graphics chip set	Matrox MGA-1064SG-G	S3 VIRGE/GX	S3 VIRGE/GX	Matrox MGA-2164WP-C
Monitor (measured diagonal size, in inches)	KDS VS-7 (15.8)	Acer 7178IE (15.7)	MAG Innovision DJ717 (16.1)	ViewSonic P7705 (16.3)
Data/fax modem speeds in Kbps (56K technology type, where applicable)	56.6/14.4 (x2)	N/A	56.6/14.4 (x2)	56.6/14.4 (x2)
Installed external RAM cache and type	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard	SuperMicro P6SNE II	Acer V82X	Intel Portland	SuperMicro P6SKE
Chip set	Intel 440FX	Intel 440FX	Intel 440FX	Intel 440FX
Multimedia Features				
CD-ROM or DVD drive speed and model	12X-24X Toshiba XM-6102B	11X-18X Acer CD-920E	12X-24X Toshiba XM-6102B	12X-24X TEAC CD-524E
Sound device	Creative Labs Sound Blaster AWE 64 Gold	Creative Labs Sound Blaster AWE 64	Creative Labs Sound Blaster AWE 64 Value	Creative Labs Sound Blaster AWE 64 Gold
MIDI synthesis type	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable
Speakers	Midland MJ-130A	None	4 iTech QX-SW32	Yamaha M15
Expandability				
Maximum RAM	768MB	384MB	256MB	768MB
Expansion-bus slots	3 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA
Front-accessible drive bays (5.25", 3.5")	3/2	3/2	2/1	3/2
Internal drive bays (5.25", 3.5")	0/1	3/2	0/2	0/2
Power-supply wattage	300	235	235	235
USB/parallel/serial/mouse ports	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1
Service and Support				
7-day, 24-hour live technical support	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	3 years/3 years	3 years/1 year	3 years/1 year
On-site service charge for 1 year	Included	Included	Included	Included
24-hour turnaround for parts replacement	■	■	■	■

N/A—Not applicable. The product does not have this feature.

COVER STORY

Professional PCs

The 74M/K266 comes with an Intel 440FX chip set, 512K of cache, and EDO DRAM in SIMMs. Most test results were average, but two noteworthy exceptions were above average: the Business Graphics WinMark 98 score (thanks to a Matrox Millennium II graphics card) and CD-ROM WinMark 98 score (attributable to the Toshiba 6102B drive). The unit's graphics card contributed to a poor 3D WinMark 98 score.

DTK offers average warranty coverage: two years for parts and labor. The on-site service costs \$50 for one year, and techni-

cal support is available during business hours on weekdays. Although the 74M/K266 is a good performer, you'll find similar systems for less.—MEB

DTK Computer Inc., City of Industry, CA; 800-289-2385, 626-810-0098; fax, 626-810-0090; www.dtkcomputer.com. Circle 455 on reader service card.

Duracom ProForma 1100

Pentium II/233, 3.1GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone score: 16.7. \$2,070 street.

The ProForma 1100, based on the 440FX

chip set, is an extremely price-competitive small-business system. The unit comes with a good warranty, but its cost-conscious component selections are reflected in low performance scores.

The Seagate ATA-3 hard disk kept the unit's Business Disk WinMark 98 score below average; the Diamond Stealth 3D graphics card contributed to a below-average Business Graphics WinMark 98 result and a very low 3D WinMark score. The result was a below-average Business Winstone 98 score. Other scores were average.

One of the few 233-MHz Pentium II

See www.pcmag.com for interactive views

Continues

PC MAGAZINE
EDITORS' CHOICE

All Computer Technology P611-266PT	AMAX GFX Pro 266	American Multisystems InfoGold P11M	Compaq Deskpro 2080 6266X/3200/CDS	Comtrade Professional PC	CyberMax Max P6 P11-266	Dell Dimension XPS D266	DFI Landmark K6-233 Pro	Digitron HT3000	DirectWave MVP VX2-266
\$3,558 direct Intel Pentium II/266 EDO DRAM IBM DHEA-36480 6.2GB Ultra ATA Matrox Millennium II (PCI) 8MB WRAM Matrox MGA-2164WP-C ViewSonic Optique V775 (16.0) 56.8/14.4 (x2) 512K pipelined-burst ASUSTek KN97-X Intel 440FX	\$3,050 direct Intel Pentium II/266 EDO DRAM Quantum Fireball ST 3.9GB Ultra ATA Matrox Millennium II (PCI) 4MB WRAM Matrox MGA-2164WP-C Impression Vienna Pro 17 (16.1) 56.8/14.4 (x2) 512K pipelined-burst Tyan Tahoe II S1682D Intel 440FX	\$3,099 direct Intel Pentium II/266 EDO DRAM Quantum Fireball ST 4.9GB Ultra ATA Matrox Millennium II (PCI) 8MB WRAM Matrox MGA-2164WP-C Trinitron SE2 Artmedia (16.0) 56.8/14.4 (x2) 512K pipelined-burst Intel KN97X Intel 440FX	\$3,280 street Intel Pentium II/266 SDRAM Maxtor 83201A6 3.1GB EIDE Matrox Mystique (PCI) 4MB SGRAM Matrox MGA-1064SG-H Compaq V70 (15.9) 56.8/14.4 (K56flex) 512K pipelined-burst Compaq Intel 440LX Intel 440LX	\$2,975 direct Intel Pentium II/266 SDRAM IBM DHEA-36480 6.2GB Ultra ATA Diamond Viper V330 (AGP) 4MB SGRAM nVidia RIVA 128 MAG Innovation DJ702 (16.0) 56.8/14.4 (x2) 512K pipelined-burst Intel AL 440LX Intel 440LX	\$2,499 direct Intel Pentium II/266 SDRAM IBM DHEA-36480 6.2GB Ultra ATA Matrox Millennium II (PCI) 4MB WRAM Matrox MGA-2164WP-C MAG Innovation DX715T (16.0) 56.8/14.4 (K56flex) 512K pipelined-burst Intel E139761 Intel 440LX	\$2,649 direct Intel Pentium II/266 SDRAM IBM DHEA-36451 7.8GB Ultra ATA STB Velocity 128 3D (AGP) 4MB SGRAM nVidia RIVA 128 Philips D1028L (15.9) 56.8/14.4 (x2) 512K pipelined-burst Intel Atlanta Intel 440LX	\$2,790 street AMD K6/233 DRAM Quantum Fireball ST 2.9GB Ultra ATA Matrox Mystique (PCI) 4MB SDRAM Matrox MGA-1064SG-D CTX V1700 (16.0) 56.8/14.4 (x2) 512K pipelined-burst DR 588ITX Intel 430TX	\$3,249 list Intel Pentium II/266 EDO DRAM IBM DHEA-36480 6.2GB Ultra ATA STB Nitro 3D (PCI) 4MB DRAM S3 VIRGE/GX CiberVision DS860 (16.0) 33.6/14.4 512K pipelined-burst BCM Advanced Research KR660 Intel 440FX	\$2,849 direct Intel Pentium II/266 SDRAM Maxtor 87000DB 6.4GB Fast ATA-2 Matrox Millennium II (AGP) 8MB WRAM Matrox MGA-2164WA-B MAG Innovation DJ7000 (16.1) 56.8/14.4 (K56flex) 512K pipelined-burst ASUSTek P2L97 Intel 440LX
8X Pioneer DVD-101 Creative Labs Sound Blaster AWE 64 FM, wavetable Jazz-596	12X-24X Toshiba XM-6102B Creative Labs Sound Blaster AWE 64 Gold FM, wavetable Sound Image Jr., QW-5W12, sub-woofer	12X-16X Toshiba XM-6002B Creative Labs Sound Blaster AWE 64 FM Yamaha M15 Amplified	12X-24X Compaq CR-5850-BCQ Compaq ESS 1888 Audio FM None	12X-24X Toshiba XM-6102B Yamaha OPL 3 FM SSI Products NTS100	12X-24X Toshiba XM-6102B Yamaha OPL 3 FM Altec Lansing ACS-45	12X-24X NEC CDR-1800A Creative Labs Sound Blaster AWE 64 Value FM, wavetable Altec Lansing ACS-290	8X Pioneer DVD-101 Creative Labs Sound Blaster 32 IDE PnP FM, wavetable ALI Midiland MU-691	8X Toshiba SD-M1002 Creative Labs Sound Blaster AWE 64 FM, wavetable SSI MT-100	12X-24X Toshiba XM-6102B Creative Labs Sound Blaster AWE 64 FM, wavetable Arkins Acoustics MX-5105
256MB 2 ISA, 4 PCI, 1 PCI/ISA 3/2 0/2 230 2/1/2/1	1GB 2 ISA, 4 PCI, 1 PCI/ISA 3/2 0/1 235 2/1/2/1	256MB 2 ISA, 4 PCI, 1 PCI/ISA 5/1 1/4 235 2/2/2/1	384MB 2 ISA, 2 PCI, 1 PCI/ISA 3/1 0/1 200 2/1/1/1	384MB 1 ISA, 3 PCI, 1 PCI/ISA 5/1 0/4 235 2/1/2/1	256MB 1 ISA, 3 PCI, 1 PCI/ISA 4/1 0/3 235 2/1/2/1	384MB 1 ISA, 3 PCI, 1 PCI/ISA 2/3 0/2 200 2/1/2/1	256MB 2 ISA, 3 PCI, 1 PCI/ISA 3/2 3/2 235 2/1/2/1	128MB 3 ISA, 3 PCI, 1 PCI/ISA 3/3 0/1 250 0/1/2/1	384MB 1 ISA, 4 PCI, 1 PCI/ISA 3/3 2/2 235 2/1/2/1
1 year/1 year \$229.98 (4 years)	3 years/1 year Included	1 year/1 year \$99	3 years/1 year Included	3 years/1 year \$25	3 years/1 year Included	3 years/1 year Included	2 years/2 years \$49	1 year/1 year \$230 (4 years)	3 years/3 years Included

COVER STORY

Professional PCs

PCs in this roundup, the ProForma 1100 also holds back on the modem, supplying a 33.6-Kbps model (upgradable to 56.6-Kbps x2). LANdesk Client Manager 3.0 software and a hardware-monitoring LM78 ASIC are included, but you'll need to supply your own network card.

Duracom Computer Systems backs its systems with a three-year warranty on parts, one year on labor; on-site support is included for the first year. Toll-free technical support is available during business hours on weekdays. If you want a Pentium II system with an Intel motherboard

without breaking your budget, consider the ProForma 1100. Just don't expect the best performance.—BB

Duracom Computer Systems, Carrollton, TX; 800-551-9000, 972-416-7600; fax, 972-416-7800; www.duracom.com. *Circle 456 on reader service card.*

EMPaC Velocity VII

Pentium II/233, 2.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 16.3. \$2,500 street.

Disappointing performance and a huge tower case mark EMPaC International

Corp.'s Velocity VII. You will have expansion room, and the system will get the job done, but you can find a better mix of features, performance, and price elsewhere.

Most of the unit's test scores were below average. One saving grace is the Velocity VII's relatively quick Toshiba XM-6002B CD-ROM drive, which helped the system to a respectable CD-ROM WinMark 98 score.

The Velocity VII's Intel 440FX-based motherboard leaves you with plenty of room for additional cards, and the full tower case has six unused drive bays. No

SUMMARY OF FEATURES

Professional PCs

	DTK APRI 74M/K266	Duracom ProForma 1100	EMPaC Velocity VII	Everex StepStation 2 TGP	First Computer Systems Pentium II-266	Gateway GP-266	Hertz II P200e	HiQ K6-233 PPC
Price of tested configuration	\$3,560 street	\$2,070 street	\$2,500 street	\$3,050 street	\$2,599 direct	\$2,899 direct	\$2,795 direct	\$2,400 street
Processor	Intel Pentium II/266	Intel Pentium II/233	Intel Pentium II/233	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	AMD K6/233
Installed RAM type	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	SDRAM	EDO DRAM	SDRAM
Hard disk	Seagate ST36450A	Seagate ST33240A	Western Digital AC 33100	Western Digital AC 33100	Seagate ST36450A	Quantum Fireball ST	Western Digital AC 33100	Quantum Fireball ST
Capacity and interface	6.2GB ATA-3	3.1GB ATA-3	2.9GB Fast ATA-2	2.9GB Fast ATA-2	6.2GB ATA-3	6.1GB Ultra ATA	2.9GB Fast ATA-2	6GB Ultra ATA
Graphics adapter (interface)	Matrox Millennium II (PCI)	Diamond Stealth 3D 2000 (PCI)	Diamond Stealth 3D 3000 (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)	STB Velocity 128 3D (AGP)	ATI All-in-Wonder (PCI)	Matrox Millennium II (PCI)
Memory	8MB WRAM	4MB EDO DRAM	4MB VRAM	4MB WRAM	4MB WRAM	4MB SGRAM	4MB DRAM	4MB WRAM
Graphics chip set	Matrox MGA-2164-WP-C	S3 VIRGE	S3 VIRGE/VX	Matrox MGA-2164-WP-C	Matrox MGA-2164-WP-C	nVidia RIVA 128	ATI 3D Rage II + DVD	Matrox MGA-2164-WP-C
Monitor (measured diagonal size, in inches)	ADI Microscan SP (16.0)	DayTek DT-1704 (16.3)	EMP Vision (16.0)	Everex 17cx (16.2)	ViewSonic Optiquest V773 (15.8)	Gateway 2000 EV900 (18.0)	Sampo AlphaScan 780 (18.2)	Panasonic Panasync S70 (16.0)
Data/fax modem speeds in Kbps (56K technology type, where applicable)	56.6/14.4 (x2)	33.6/14.4	56.6/14.4 (x2)	56.6/14.4 (K56flex)	56.6/14.4 (K56flex)	56.6/14.4 (x2)	33.6/14.4	56.6/14.4 (x2)
Installed external RAM cache and type	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard	DTK PRM-00741	Intel PD 440FX	Microstar MS6109 ver. A	ASUSTek KN-B010	Intel PD 440FX	Intel Atlanta	Hertz KN97-X	ASUSTek TX97-XE
Chip set	Intel 440FX	Intel 440FX	Intel 440FX	Intel 440FX	Intel 440FX	Intel 440LX	Intel 440FX	Intel 430TX
Multimedia Features								
CD-ROM or DVD drive speed and model	12X-24X Toshiba XM-6102B	9X-16X Sony CDU-511	12X-16X Toshiba XM-6002B	11X-24X NEC CDR-1600A	12X-24X Panasonic CR-585-C	7X-12X Toshiba XM-5702B	11X-16X Mitsubishi CRM-FX-140S	12X/24X TEAC CD-524E
Sound device	Creative Labs Sound Blaster AWE 64	Yamaha OPL3	Creative Labs Sound Blaster AWE 64 Value	Creative Labs Sound Blaster 32 IDE PnP	Yamaha OLS 3	Ensoniq Audio PCI	Yamaha 3D Audio	Creative Labs Sound Blaster AWE 64 Gold
MIDI synthesis type	FM, wavetable	FM	FM, wavetable	FM, wavetable	FM	Wavetable	FM, wavetable	FM, wavetable
Speakers	Jupiter ACS919	None	Empac	Ben Win 8W891H	Sun 89H	Boston Acoustics Micro Media Sound System	Altec Lansing ACS51	Yamaha YSTM-15
Expandability								
Maximum RAM	512MB	256MB	1GB	768MB	256MB	384MB	384MB	128MB
Expansion-bus slots	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA
Front-accessible drive bays (5.25", 3.5")	4/2	3/2	5/1	3/2	3/1	3/1	3/2	2/3
Internal drive bays (5.25", 3.5")	0/2	0/3	0/3	0/2	0/2	0/3	0/1	0/2
Power-supply wattage	250	235	235	235	235	200	235	235
USB/parallel/serial/mouse ports	2/1/2/1	2/1/2/1	0/1/2/1	2/1/2/1	2/2/2/1	2/1/2/1	2/1/2/1	2/1/2/1
Service and Support								
7-day, 24-hour live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	2 years/2 years	3 years/1 year included	3 years/3 years	3 years/3 years	1 year/lifetime	3 years/1 year included	3 years/3 years	3 years/1 year
On-site service charge for 1 year	\$50		\$120		\$98		\$195	\$149
24-hour turnaround for parts replacement	■	■	■	■	■	■	■	■

N/A—Not applicable. The product does not have this feature.

components are obstructed, so you should have no problems with future upgrades or servicing. The unit also comes with a Creative Labs Sound Blaster AWE64 audio card and an 56.6-Kbps x2 modem.

EMPaC's warranty covers three years parts and one year labor. On-site service is \$120 for a year. Although the price is attractive, you'll find better deals among the other systems in this roundup.—**JAH**
EMPaC International Corp., Fremont, CA; 800-938-8878, 510-683-8800; fax, 510-683-8662; www.empac.com. **Circle 457 on reader service card.**

Everex StepStation 2 TGP

Pentium II/266, 2.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.8. \$3,050 street.

Everex Systems' StepStation 2 TGP is aimed at professional users who demand relatively fast graphics performance. Everex offers a good warranty with the StepStation 2 TGP, but lower-than-average graphics and disk test scores mar the unit.

A Western Digital Fast ATA-2 hard disk led the system to a below-average Business Disk WinMark 98 score, and a

PCI Matrox Millennium II video card produced below-average 3D WinMark and Business Graphics WinMark 98 results, the latter perhaps because of poor driver optimization. Other scores were average.

The StepStation 2 TGP comes with a Maxtech 56.6-Kbps K56flex modem and Intel's LANdesk Client Manager 3.0 (Version 3.1 will be included when available).

Everex's three-year warranty with first-year on-site service and 24-hour, 7-day, toll-free technical support gives it an edge above many other companies. The support content of its Web site is also first-rate.

See www.pcmag.com for interactive views

Continues

PC MAGAZINE
EDITORS' CHOICE

Hymco HWS6266B	IBM PC300XL	Initiative ITI-266P2	Intergraph TD-225	Kingdom Pinnacle 266	Magitronic G-PZ266AGP	Mega Impact Pentium II 266 AGP	MicroFlex- K5/Professional	Micron Millennia XKU	Micro X MXP-6100	NEC Direction SPL266
\$3,000 street	\$4,010 street	\$2,575 direct	\$2,990 direct	\$2,297 direct	\$2,700 street	\$2,750 street	\$1,899 direct	\$3,418 direct	\$2,799 direct	\$3,037 direct
Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	AMD K6/233	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266
SDRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	SDRAM	SDRAM	SDRAM	SDRAM	EDO DRAM	SDRAM
Quantum Fireball ST	IBM DCAA-3433D	Quantum Fireball ST	Fujitsu MPA3035AT	Quantum Fireball TM	Western Digital AC 33100	Quantum Fireball ST	Quantum Fireball ST	IBM DHEA-36480	Western Digital AC 34300	IBM DHEA-36480
2.9GB Ultra ATA	4GB ATA-3	2.9GB Ultra ATA	3.2GB Ultra ATA	3.7GB Fast ATA-2	2.9GB Fast ATA-2	4.1GB Ultra ATA	4.3GB Ultra ATA	6.2GB Ultra ATA	4.1GB Ultra ATA	6.2GB Ultra ATA
Matrox Millennium II (AGP)	Matrox Millennium II (PCI)	Matrox Millennium (PCI)	Matrox Millennium (PCI)	Hercules Dyna-mite 128 (PCI)	Matrox Millennium II (AGP)	ATI 3D Rage Pro (AGP)	Matrox Millennium II (PCI)	Diamond Viper V330 (PCI)	Matrox Millennium II (PCI)	Number Nine Revolution 3D (AGP)
8MB WRAM	8MB WRAM	4MB WRAM	4MB WRAM	4MB DRAM	8MB WRAM	4MB SGRAM	4MB WRAM	4MB SGRAM	8MB WRAM	8MB WRAM
Matrox MGA-2164WA-B	Matrox MGA-2164WP-C	Matrox MGA-2064W-R3	Matrox MGA-2064W-R2	Tseng ET6000 Labs	Matrox MGA-2164WA-8	ATI 3D RAGE II	Matrox MGA-2164WP-C	nVidia RIVA 128	Matrox MGA-2164WP-C	Number Nine Ticket2Ride
Viewsonic 17PS 1786PS (16.0)	IBM P70 (15.9)	ViewSonic 17EA (18.1)	Intergraph TX-D1751W (16.3)	Kingdom 701 (16.0)	Pro-Corp Pro-SV-1701P (16.0)	MGC MGC-1785 (15.6)	Princeton E070 (16.7)	Hitachi CM751U (18.0)	Princeton E075 (15.9)	NEC Multisync C700 (16.0)
33.8/14.4	56.6/14.4 (x2)	56.6/14.4 (x2)	33.8/14.4	33.8/14.4	56.6/14.4 (x2)	N/A	56.6/14.4 (K56flex)	56.6/14.4 (x2)	33.8/14.4	56.6/14.4 (x2)
512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Intel AL440LX	IBM PC 300 XL	Tyan S1680	Tyan Natoma	Elite P6KFX-A	BCM Advanced KR630	BCM Advanced Research KR630	Micro Express Metex	Intel AL440LX	SuperMicro P6 SNE II	Intel Atlanta
Intel 440LX	Intel 440 FX	Intel 440FX	Intel 440FX	Intel 440FX	Intel 440LX	Intel 440LX	Intel 430TX	Intel 440LX	Intel 440FX	Intel 440LX
5X Creative Labs MK5000	9X-16X Sony CDU-511	11X-16X Mitsumi CRM-CF-140S	7X-12X Toshiba XM-5702B	12X-24X Acer CD-624A	12X-24X Toshiba XM-6102B	12X-24X Toshiba XM-6102B	12X-24X Toshiba XM-6102B	12X-24X Hitachi CDR-8330	12X-24X LiteOn LTN 242	12X-24X Goldstar CRD-8240B
Yamaha OPL3-SA3	Creative Labs Sound Blaster AWE 64	Creative Labs Sound Blaster AWE 64 Gold	Ensoniq Audio PCI	Ensoniq Audio PCI	Creative Labs Sound Blaster AWE 64 Gold	Crystal	Creative Labs Sound Blaster AWE 64	Yamaha OLS 3	Ensoniq Audio PCI	Yamaha OLS 3
FM	FM, wavetable	FM, wavetable	Wavetable	Wavetable	FM, wavetable	FM	FM, wavetable	FM	Wavetable	FM, wavetable
Altec Lansing ACS51	None	None	NMB	Symphony 4000	Hi Tex CP-SW2, subwoofer	King Tex EP260	Creative Labs Mii 180	Advent AV270	Justus 500W	Altec Lansing ACS45
384MB	384MB	1GB	512MB	384MB	768MB	384MB	256MB	384MB	768MB	384MB
1 ISA, 4 PCI, 1 PCI/ISA	1 ISA, 0 PCI, 3 PCI/ISA	4 ISA, 5 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 4 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA
3/2	2/1	3/2	2/1	3/2	3/2	3/2	3/2	2/3	4/1	2/3
2/2	0/2	0/4	2/3	0/2	0/3	0/2	0/1	1/1	0/3	3/1
235	200	230	250	250	235	235	235	235	250	235
2/1/2/1	2/1/1/1	2/1/2/0	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	0/1/2/1	2/1/2/1
2 years/1 year	3 years/1 year	1 year/1 year	3 years/1 year	3 years/1 year	2 years/2 years	2 years/2 years	4 years/4 years	3 years/1 year	3 years/5 years	3 years/3 years
\$99	Included	Included	Included	Included	Included	Included	\$50	Included	Included	Included

Professional PCs

The StepStation 2 TGP gets the job done and comes with good support, but you may find better values elsewhere.—BB

Everex Systems Inc., Fremont, CA; 800-383-7391, 510-498-1111; fax, 510-683-2186; www.everex.com. Circle 459 on reader service card.

First Computer Systems Pentium II-266

Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 19.3. \$2,599 direct.

First Computer Systems' FCS Pentium II-

266 provides competitive performance at a reasonable cost.

The Seagate hard disk and Matrox Millennium II graphics card helped the Pentium II-266 reliably deliver average performance for its class. The graphics card, however, led the unit to a poor 3D WinMark 98 result.

The DMI 2.0-compliant model uses an Intel 440FX-based motherboard. An on-board Yamaha chip set handles audio, leaving six expansion slots free. The unit comes with a Hayes 56.6-Kbps K56flex modem.

Nice touches include a CD full of useful

motherboard data and Intel's LANDesk Client Management 3.0 (Version 3.1 will be included when available). Weak links include less-than-optimal sound from the Sun 69H speakers and an odd, locking power switch that makes it difficult to tell whether the unit is on or off.

Small-business buyers may find the Pentium II-266's mix of average performance and good price appealing.—JAH
First Computer Systems Inc., Lawrenceville, GA; 800-325-1911, 770-441-1911; fax, 770-441-1856; www.fcsnet.com. Circle 459 on reader service card.

SUMMARY OF FEATURES

Professional PCs

■ YES ■ NO

Products listed in alphabetical order

	NETIS Starburst 266	Nova K6-233	PC Channel/CTX LAK233-32	Polywell 7266LX5	Premio Apollo FX2 266	ProGen Polaris 266 W95	Quantex QP6/266 SM-4X	Royal Synergy Pro
Price of tested configuration	\$2,390 street	\$2,899 direct	\$1,900 street	\$2,650 direct	\$3,050 street	\$2,700 direct	\$2,499 direct	\$3,107 direct
Processor	Intel Pentium II/266	AMD K6/233	AMD K6/233	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266
Installed RAM type	EDO DRAM	SDRAM	EDO DRAM	SDRAM	EDO DRAM	SDRAM	EDO DRAM	EDO DRAM
Hard disk	Western Digital AC 33100	Quantum Fireball ST	Quantum Fireball ST	Maxtor 87000A8	IBM DCAA-34330	Maxtor 87000D8	IBM DCAA-34330	Maxtor 85120A8
Capacity and interface	2.9GB Fast ATA-2	6.1GB Ultra ATA	6GB Ultra ATA	6.7GB Ultra ATA	4GB ATA-3	6.7GB Ultra ATA	4GB ATA-3	4.9GB Ultra ATA
Graphics adapter (interface)	Matrox Millennium (PCI)	Matrox Millennium II (PCI)	Matrox Mystique (PCI)	ATI 3DXpression PC2TV (AGP)	Matrox Millennium II (PCI)	Matrox Millennium II (AGP)	Matrox Millennium II (PCI)	ATI 3D Pro Turbo (PCI)
Memory	4MB WRAM	4MB WRAM	4MB SGRAM	4MB SGRAM	8MB WRAM	8MB WRAM	4MB WRAM	8MB SGRAM
Graphics chip set	Matrox MGA-2064WP-C	Matrox MGA-2164WP-C	Matrox MGA-1064SG-D	ATI 3D Rage Pro	Matrox MGA-2164WP-C	Matrox MGA-2164WA	Matrox MGA-2164W	ATI 3D Rage II + DVD
Monitor (measured diagonal size, in inches)	Sampo KM-711 (16.0)	MAG DJ700 (16.2)	CTX VL700 (15.7)	Sampo KM-711 (15.8)	Premio 514CA (15.9)	Panasonic Panasync S17 (16.0)	MAG 720JV2 (16.1)	Utopia XP 400 (16.1)
Data/fax modem speeds in Kbps (56K technology type, where applicable)	33.6/14.4	56.6/14.4 (x2)	56.6/14.4 (K56flex)	33.6/14.4	56.6/14.4 (x2)	56.6/14.4 (K56flex)	56.6/14.4 (K56flex)	56.6/14.4 (x2)
Installed external RAM cache and type	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K synchronous	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard	Intel PD 440FX	Giga-Byte PT-2011	Biostar M8500TUD	Microstar MS-6111/440 LX	Microstar MS-6109	BCM Advanced Research KR630	Intel 440FX	ODI P61440FX Commander III
Chip set	Intel 440FX	Intel 430TX	Intel 430TX	Intel 440 LX	Intel 440FX	Intel 440LX	Intel 440FX	Intel 440FX

Multimedia Features

CD-ROM or DVD drive speed and model	7X-12X Toshiba XM-5702B	12X Creative Labs	12X-24X Lite-On LTN 242	12X-16X Toshiba XM-6002B	11X-16X Mitsumi CRM-CX-140S	8X Pioneer DVD-101	12X-24X Toshiba XM-6102B	8X Toshiba SD-M1002
Sound device	Yamaha OPL 3	Creative Labs Sound Blaster AWE 64	Opti 931	Crystal 3D16	Creative Labs Sound Blaster AWE 64	GVC Media Technology SP 802	Yamaha OPL4	Yamaha OPL3
MIDI synthesis type	Wavetable	FM, wavetable	Wavetable	FM	FM, wavetable	Wavetable	Wavetable	FM, wavetable
Speakers	None	Roland 85 Watts	CTX	Quick Shot SF300	Midland MLI-130	Midland S25+	Altec Lansing ACS-45W	Royal Professional Speakers

Expandability

Maximum RAM	256MB	256MB	128MB	256MB	512MB	1GB	128MB	128MB
Expansion-bus slots	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA
Front-accessible drive bays (5.25" / 3.5")	3 / 1	2 / 3	3 / 2	3 / 2	3 / 2	3 / 2	4 / 1	3 / 2
Internal drive bays (5.25" / 3.5")	0 / 1	0 / 2	3 / 1	0 / 1	3 / 2	0 / 2	0 / 3	0 / 1
Power-supply wattage	160	235	235	300	200	235	235	235
USB/parallel/serial/mouse ports	2 / 1 / 2 / 1	2 / 1 / 2 / 1	0 / 2 / 2 / 1	2 / 1 / 2 / 1	2 / 1 / 2 / 1	2 / 1 / 2 / 1	2 / 1 / 2 / 1	2 / 1 / 2 / 1

Service and Support

7-day, 24-hour live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/1 year	3 years/3 years	1 year/1 year	3 years/5 years	3 years/3 years	3 years/1 year	3 years/1 year	1 year/1 year
On-site service charge for 1 year	Included	\$50	Included	Included	\$50	Included	Included	\$44.95
24-hour turnaround for parts replacement	■	■	■	■	■	■	■	■

N/A—Not applicable. The product does not have this feature.

COVER STORY

Professional PCs

Gateway GP-266

Pentium II/266, 6.1GB hard disk, 19-inch monitor, SDRAM. Business Winstone 98 score: 19.9. \$3,128 direct.

The Gateway GP6-266 is a fully equipped version of Gateway 2000's professional line of systems. The GP line starts with fewer components than the G line of multimedia systems, giving corporate purchasers more configuration flexibility. Features such as a 19-inch EV900 monitor, AGP graphics, and Boston Acoustics speakers add to the unit's appeal.

The GP-266 had mostly average results on our tests. Its AGP STB Velocity 128 3D video card is particularly well suited for 3-D functions—gamers take note—and yielded a great 3D WinMark 98 score. This card is not as good for 2-D and business graphics, however; it gave the unit a below-average Graphics WinMark 98 score.

The unit features a Gateway-branded 56.6-Kbps modem, and it also comes with Microsoft Office 97 Small Business Edition and Encarta 97.

Gateway backs the GP-266 with a warranty of three years on parts, one year on

labor, one year of on-site service, and 24-hour, 7-day technical support. The GP-266 is a good option for professionals looking for a great components and competitive performance.—BB

Gateway 2000 Inc., North Sioux City, SD; 800-338-0169, 605-232-2000; fax, 605-232-2023; www.gateway.com. Circle 460 on reader service card.

Hertz II P266e

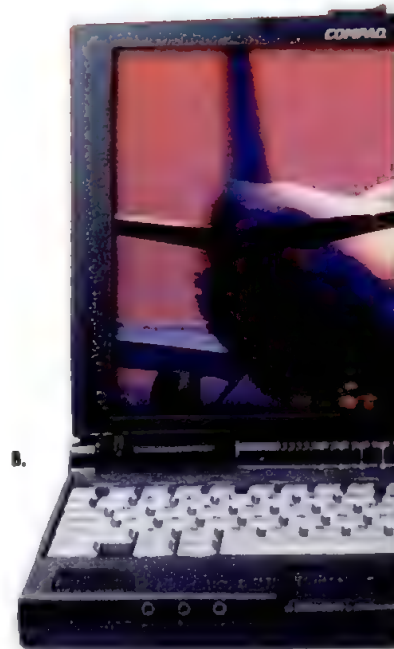
Pentium II/266, 2.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 17.0. \$2,795 direct.

See www.pcmag.com for interactive views

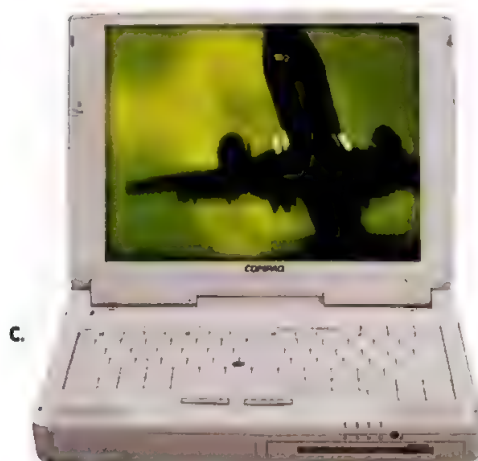
Ends

SAG PII 266	Seamix CS Power 266	Sys Performance Pro 266LA	Targem Thunderbolt New Generation VII	Tangent Petra II 266	Tempest 3D-128 Pro	Tiger AMD-K5 233 MMX	UmaxStation 6000	Unicent Avanta 266XLP	Vektron Vision2-266	XI 532GP MTower
\$2,888 direct	\$2,459 direct	\$2,694 direct	\$2,499 direct	\$2,895 direct	\$2,498 direct	\$1,695.99 direct	\$3,295 direct	\$2,899 direct	\$2,795 direct	\$3,049 direct
Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	AMD K5/233	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266	Intel Pentium II/266
EDO DRAM	EDO DRAM	EDO DRAM	SDRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	SDRAM	SDRAM	SDRAM
IBM DHEA-36480	Quantum Fireball ST	IBM DHEA-36480	IBM DHEA-36480	DCAA-34330	Quantum Fireball ST	Quantum Bigfoot	Western Digital AC 34000	Quantum Fireball ST	Quantum Fireball ST	Maxtor 8700008
6.2GB Ultra ATA	6.2GB Ultra ATA	6.4GB Ultra ATA	6.4GB Ultra ATA	4GB ATA-3	3.1GB Ultra ATA	4.1GB FastATA-2	3.8GB Ultra ATA	4.1GB Ultra ATA	6.1GB Ultra ATA	6.4GB Ultra ATA
Number Nine Revolution 3D (PCI)	Matrox Millennium II (PCI)	Number Nine Revolution 3D (AGP)	Number Nine Revolution 3D (AGP)	STB Nitro 3D (PCI)	Matrox Millennium II (PCI)	Matrox Mystique (PCI)	Matrox Millennium (PCI)	Matrox Millennium II (AGP)	Matrox Millennium II (AGP)	Number Nine Revolution 3D (PCI)
8MB WRAM	4MB WRAM	8MB WRAM	8MB WRAM	4MB DRAM	4MB WRAM	4MB DRAM	4MB WRAM	8MB WRAM	8MB WRAM	8MB WRAM
Number Nine Ticket2Ride	Matrox MGA-2164WP-C	Number Nine Ticket2Ride	Number Nine Ticket2Ride	S3 VIRGE/GX	Matrox MGA-2164WP-C	Matrox MGA-1064SG-D	Matrox MGA-2064W-R2	Matrox MGA-2164WA-B	Matrox MGA-2164WA-B	Number Nine Ticket2Ride
Hitachi CM7510 (18.2)	Seamix KM-711 (16.0)	SYS SPM-17-MS (15.9)	Targem TM-785 (16.1)	CTX FX-7100 (15.7)	Scopette P73 (15.8)	KDS Visual Sensations (15.8)	Hitachi Superscan Elite 630 (16.1)	Princeton ED17 (16)	MAG DJ707 (16.1)	Optique V775 (16.0)
N/A	56.6/14.4 (K56flex)	56.6/14.4 (x2)	56.6/14.4 (K56flex)	56.6/14.4 (x2)	56.6/14.4 (K56flex)	33.6/14.4	56.6/14.4 (K56flex)	56.6/14.4 (x2)	56.6/14.4 (x2)	56.6/14.4 (x2)
512K synchronous	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
American Megatrends Pegasus 759	Intel PD440FX	Giga-Byte GA-686LX	BCM Advanced Research KR630	Tyan Tachet II-S1688	Giga-Byte GA-686KX	FCI PA-2011	ASUS K57-X	Intel AL440LX	BCM Advanced Research KR630	SuperMicro P6DLS
Intel 440FX	Intel 440FX	Intel 440LX	Intel 440LX	Intel 440FX	Intel 440FX	VIA Apollo II	Intel 440FX	Intel AL440LX	Intel 440LX	Intel 440LX
12X-24X Toshiba XM-6102B	12X-24X Toshiba XM-6102B	12X-24X TEAC CD-524E	12X-24X Panasonic CR-585B	12X-16X Toshiba XM-6002B	12X-24X Panasonic CR-585B	11X-20X Lite-On LTN 264	12X-24X Matsushita CR-585	8X Toshiba SD-M1002	12X-24X Pioneer DR-511	12X-24X TEAC CD-524E
Creative Labs Sound Blaster AWE 64 Value	Ensoniq Audio PCI	Creative Labs Sound Blaster 32 PnP	Crystal Sound Vision	Creative Labs Sound Blaster AWE 64	Creative Labs Sound Blaster AWE 64	IBM MDSP2780	Creative Labs Vibra 16CL	Yamaha OPL 3	Creative Labs Sound Blaster AWE 64 Gold	Yamaha OPL3-SAX
FM, wavetable	Wavetable	FM, wavetable	FM	FM, wavetable	FM, wavetable	Wavetable	FM	FM	FM, wavetable	FM
None	Altec Lansing ACS 400	Midiland ML-818	4Q OX-F55	Altec Lansing ASC45	Justar Speakers 695	Yamaha YSTM7	Yamaha	Premier SW 32	Altec Lansing ACS45, subwoofer	Altec Lansing ACS 45W
512MB	128MB	1GB	384MB	1GB	768MB	512MB	384MB	384MB	128MB	512MB
2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
3/2	3/2	3/2	4/2	2/3	3/2	3/2	3/2	2/3	3/2	3/2
0/1	0/2	0/3	0/4	0/3	0/2	0/1	0/2	0/1	3/2	0/1
250	250	235	250	230	254	150	250	250	230	250
0/1/2/0	2/1/1/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1	2/1/2/1
2 years/2 years	Varies/various	Varies/1 year	3 years/1 year	3 years/3 years	1 year/1 year	1 year/1 year	3 years/3 years	5 years/3 years	1 year/1 year	3 years/3 years
\$75	\$99	Included	\$49	Included	\$165	Included	Included	Included	Included	Included

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Armada	A. 1500 Family Everything's integrated, including solid value	B. 4100 Family The three-in-one notebook that's as adaptable as you are	C. 7300 Family The ideal combination of power and mobility	D. 7700 Family The true technology powerhouse
Processor	133MHz Pentium® Processor— 133MHz–166MHz Pentium Processor with MMX™ technology	150MHz–166MHz Pentium Processor with MMX technology	150MHz–166MHz Pentium Processor with MMX technology	150MHz–233MHz Pentium Processor with MMX technology
Display	12.1" TFT or 12.1" CSTN (SVGA)	12.1" TFT or 12.1" CSTN (SVGA)	12.1" TFT (SVGA)	12.1" TFT (SVGA or 1024 x 768)
Standard/Max Memory	16MB EDO RAM up to 80MB	16MB up to 80MB	16MB or 32MB EDO up to 128MB	16MB or 32MB EDO RAM up to 144MB
Hard Drive (SMART)	1.4GB–2.1GB	1.6GB–2.0GB	2.1GB	1.6GB–3.0GB (up to 5.0GB optional)
CD-ROM	10X or 20X (varies with model)	20X optional	8X or 20X optional	8X or 20X optional (standard on 7770)
Modem	Integrated 33.6 Kbps data/fax	Compaq PC Card optional	Integrated 33.6 telephony on 7350MT Compaq PC Card option on 7330T	Integrated 33.6 Kbps telephony Upgradable to K56 flex protocol*
Integrated AC Adapter	Yes	No	No	Yes
Battery Type/Life**	Li-Ion up to 3.5 hr (up to 2 batteries)	Li-Ion up to 3 hr (up to 3 batteries)	Li-Ion up to 3 hr	Li-Ion up to 2.5 hr (up to 2 batteries)
Desktop Expansion	Convenience Base (with or without Ethernet)	Convenience Base (with or without Ethernet)	Convenience Base or ArmadaStation Expansion Base (with tower stand optional)	Convenience Base or ArmadaStation Expansion Base (with tower stand optional)
Intelligent Manageability	Yes	Yes	Yes	Yes
Dimensions/Weight	21" x 12.2" x 9.6" / 7.4 lb–7.5 lb	Slimline: 15" x 11.4" x 8.8" / 5.3 lb Standard: 15" x 11.6" x 10.3" / 6.2 lb Multimedia: 23" x 12.6" x 9.5" / 8.3 lb	9.3" x 12" x 1.5" / 6.0 lb	20" x 12.6" x 9.5" / 7.8 lb–7.9 lb
Limited Warranty†	1-year worldwide limited warranty with optional 2-year upgrade available	3-year worldwide limited warranty	3-year worldwide limited warranty	3-year worldwide limited warranty



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below-average CPUmark₃₂, Business Winstone 98 and Business Graphics WinMark 98 results. Disk and CD-ROM results were average. Since the 6MB Matrox Millennium II graphics card does not support most 3-D functions, the unit's 3-D results were poor.

A Creative Labs AWE64 card and Yamaha speakers

provide first-rate sound. A sleep button is supposed to put the unit in a suspended state for instant power-on. This feature did not work on our PC, but the vendor says it now works as intended.

The unit has a warranty of three years on parts, one year on labor. Technical support is offered during business hours on weekdays and 11:00 to 4:00 on Saturdays. Drivers are available from HiQ's Web site.

Brand-name components enhance the appeal of this HiQ system, but other PCs in this roundup offer better value.—*FJE*
HiQ Computer Systems, Sunnyvale, CA; 800-827-5836, 408-245-5836; fax, 408-245-3108; www.hiq.com. *Circle 462 on reader service card.*

Hymco HWS6266B

Pentium II/266, 2.9GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 20.3. \$3,000 street.

Hymco Technologies' Hymco HWS6266B is meant for demanding professional users, and represents a particularly good value with its bundled DVD drive, AGP graphics card, and competitive performance.

An Intel motherboard with LX chip set and SDRAM aided the unit's performance on our tests, as did its Matrox Millennium II AGP card, which pushed its Business Graphics WinMark 98 score to above average. This graphics card contributed to a below-average 3D WinMark 98 score.

Configuring DVD is often problematic. Hymco includes helpful setup sheets as well as two audio cables, because the Creative Labs solution requires separate audio-out cables for CD and DVD audio. The unit also has Altec Lansing ACS51 speakers.

Hymco provides a warranty of two years on parts, one year on labor, and offers toll-call technical support during weekday business hours. On-site warranty coverage for the first year costs \$99. The

company's Web site suffers from a somewhat confusing layout and spotty content.

If you don't need hand-holding and want a lot of system for the money, the HWS6266B is a reasonable choice.—*BB*
Hymco Technologies Inc., San Jose, CA; 800-884-9626, 408-251-6888; fax, 408-251-2333; www.hymco.com. *Circle 463 on reader service card.*

IBM PC300XL

Pentium II/266, 4GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.5. \$4,010 street.

IBM PC Co.'s IBM PC300XL offers some of the best available solutions for those with doubts about their own abilities to get a PC going and keep it going. The unit, meant for larger businesses, was also a competitive performer on our tests.

Expansion is no problem, and the IBM motherboard incorporates audio, video, and even 10/100Base-T circuitry in addition to standard ports. Despite the integrated components, IBM equips the unit with a Creative Labs Sound Blaster AWE64 sound board and a PCI-based Matrox Millennium II graphics adapter with 8MB of WRAM. With these components, the unit earned an above-average Business Graphics WinMark 98 score and average scores on our other tests. Its 3D WinMark 98 result, however, was poor.

The highlight of this PC is its manageability: It's compliant with DMI 2.0 and offers wake-on-LAN capability, which IBM pioneered, as well as other administrative features. The system also switches on by network command and will even let you remotely reprogram its BIOS.

IBM's support is also appealing. You'll even find the jumpers documented inside the lid of the heavyweight case. A wad of hand-holding software, a three-year-parts, one-year-labor warranty with one year of on-site service, and round-the-clock support complete the package. The unit comes with an IBM 56.6-Kbps DSVD modem.

If you want to manage your PCs seriously, this is a good bet; bargain hunters should look elsewhere.—*WLR*

IBM PC Co., Research Triangle Park, NC; 800-426-2968, 919-558-5221; fax, 800-426-3395; www.us.pc.ibm.com/desktop. *Circle 464 on reader service card.*

With the Hertz II P266e, Hertz Computer Corp. targets buyers who want the latest technology and the last drop of performance. Though the P266e has a good sound subsystem, when measured against some tough competition in this roundup, it doesn't quite hit the mark.

The P266e could not keep up with other systems on most tests. The unit's ATI All-in-Wonder graphics board yielded an extremely low Business Graphics WinMark 98 score and a poor 3D WinMark 98 result. The unit's Western Digital hard disk pulled its Business Disk WinMark 98 score down to below average. The Business Winstone 98 score was also below average.

A 33.6-Kbps modem (which is upgradable to 56.6-Kbps x2) is included with the unit. Yamaha OPL3 and OPL4 audio and Altec Lansing ACS51 speakers provide better-than-average audio performance.

A three-year warranty is standard, with on-site service available for \$195 a year. Technical support is available weekdays, during extended business hours, and around the clock via a paging service. The P266e will get the job done, but you'll find better values elsewhere.—*BB*

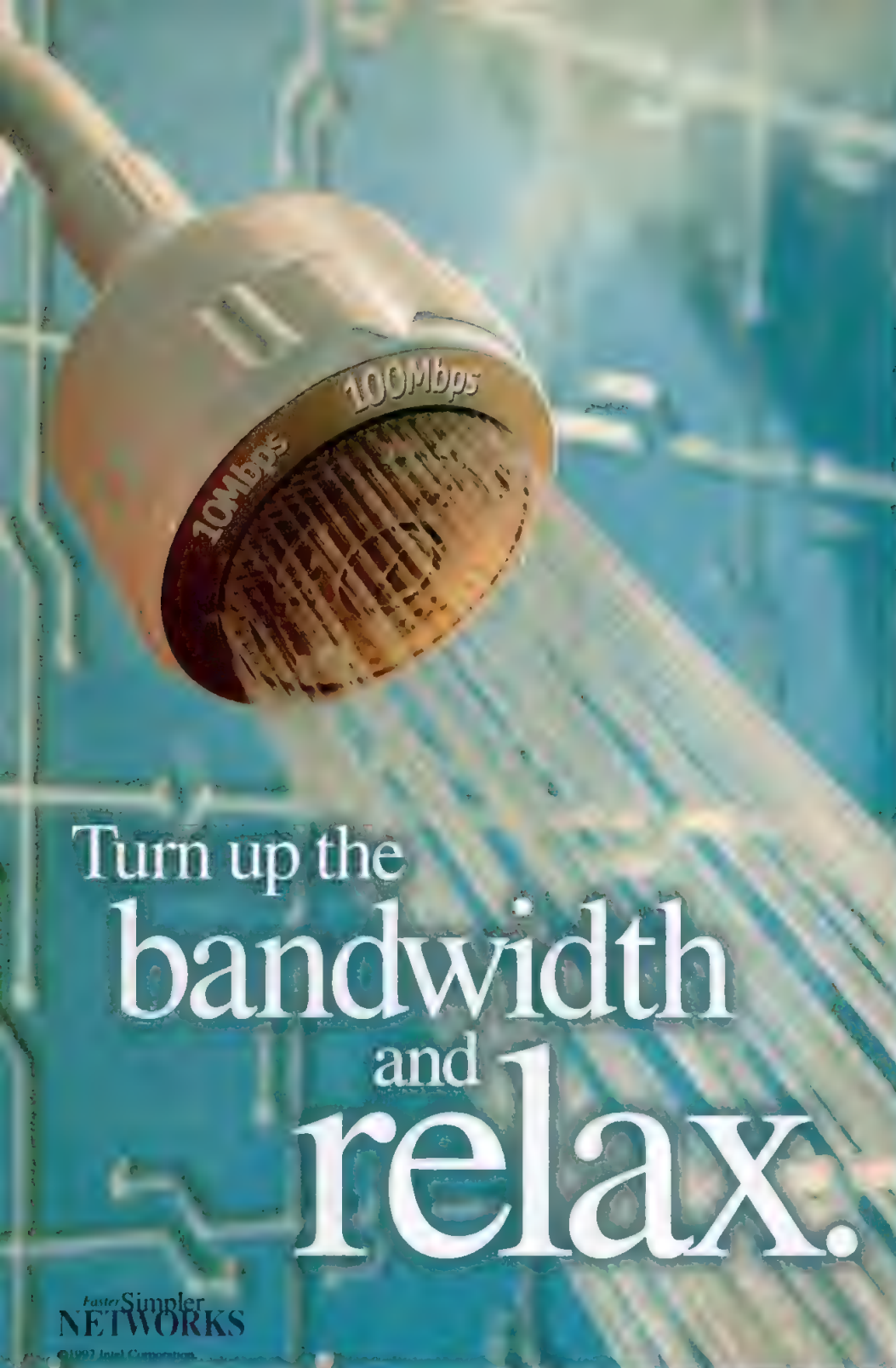
Hertz Computer Corp., New York; 888-222-7280, 212-634-4280; fax, 212-634-4285; www.hertzttec.com. *Circle 461 on reader service card.*

HiQ K6-233 PPC

K6/233, 6GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 16.4. \$2,400 street.

Although HiQ Computer Systems' HiQ K6-233 PPC packs some good components, true bargain hunters will find better deals elsewhere, and power seekers will not be satisfied with its performance.

The unit's K6/233 CPU could not keep up in the field of Pentium II/266s, leading to



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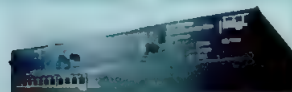
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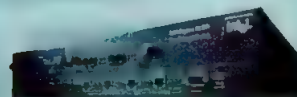


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Initiative ITI-266P2

Pentium II/266, 2.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 19.9. \$2,575 direct.

Initiative Technology targets large corporate customers and government buyers with the ITI-266P2. Despite an older graphics card, the no-frills ITI-266P2 has good graphics performance; its disk results are not as good, however.

At first, the use of an older Matrox Millennium graphics card appears to be a disadvantage. Indeed, the MGA 2064-based card is sorely lacking in 3-D features—the unit's 3D WinMark 98 score was low—but the Millennium actually outperformed most of its newer rivals on standard 2-D graphics tasks, earning the unit an above-average Business Graphics WinMark 98 score. The system's Business Winstone 98 score was average, but its Quantum Fireball hard disk and Mitsumi 14X CD-ROM drive pulled performance to below average on disk and CD-ROM tests.

The case design permits access from both sides and lets you remove the motherboard from the back. Inside there is room for 1GB of SIMM-based memory. A 56.6-Kbps x2 modem is included.

The vendor provides a one-year warranty; tech support is available only on weekdays, during business hours. The ITI-266P2's price and good graphics performance earn it some consideration.—JAH
Initiative Technology Inc., Brownwood, TX; 800-544-4700, 512-476-2528; fax, 512-476-0574; www.initiative-tech.com. *Circle 465 on reader service card.*

Intergraph TD-225

Pentium II/266, 3.2GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 19.8. \$2,990 direct.

Intergraph Computer Systems' Intergraph TD-225 is meant for technical and creative professionals using applications such as CAD and animation. With mostly average performance and a dual-CPU motherboard, the TD-225 is a reasonable buy if you don't use 3-D functions.

The TD-225's Intel 440FX chip set and EDO DRAM are not the newest technologies, but the unit holds its own, with average scores on most tests. Its 3D WinMark 98 score was very poor, however.

The system includes a 33.6-Kbps modem and an NMB keyboard with speakers and SRS 3-D sound. The keyboard audio saves space and is fine for business audio but breaks up at high volumes.

A warranty of three year on parts, one year on labor with a year of on-site service is backed by toll-free tech support weekdays from 7:00 to 7:00. For off hours, Intergraph has a well-organized Web site with good support and product information.

For most PC chores, including 2-D graphics applications, the TD-225 is a fair choice. Intergraph's target market will probably want better 3-D graphics performance and newer hardware.—BB

Intergraph Computer Systems, Huntsville, AL; 800-345-4856, 205-730-2000; fax, 205-730-8300; www.intergraph.com. *Circle 466 on reader service card.*

Kingdom Pinnacle 266

Pentium II/266, 3.7GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 19.0. \$2,297 direct.

Kingdom Computers has been selling PCs since 1991, mostly to government and educational institutions. The Kingdom Pinnacle 266, however, is also targeted at home and business users who have higher-than-average demands. Bargain hunters may find this system appealing despite some lackluster performance.

The system earned average Business Winstone 98 and CPUmark₃₂ scores but faltered on our disk and graphics tests, earning below-average results for its class. Its 12X CD-ROM drive also contributed to below-average scores. The unit's Hercules Dynamite 128 graphics card produced a

low 3D WinMark 98 score.

The unit comes with a 33.6-Kbps modem (upgradable to 56.6-Kbps K56flex), an Ensoniq audio card with Symphony 4000 speakers, and good software, including Compton's Interactive Encyclopedia and Lotus SmartSuite 97. Kingdom provides on-site service during the first year and toll-free technical support weekdays and Saturdays.

For cost-conscious professionals, the Kingdom Pinnacle 266 is an acceptable choice. True power users will look elsewhere or specify higher-performance components.—BB

Kingdom Computers, Mansfield, PA; 800-385-3436, 717-662-7515; fax, 717-662-3875; www.kingdomcomputers.com. *Circle 467 on reader service card.*

Magitronic G-P2266AGP

Pentium II/266, 2.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.7. \$2,700 street.

Good performance and lots of room to grow recommend Magitronic Technology's Magitronic G-P2266FM. One caveat: Our test unit could not complete our benchmark tests because of a minor but disabling component failure (which would be covered under warranty).

The unit produced average scores on most of our tests, except for above-average Business Graphics WinMark 98 and CD-ROM WinMark 98 results. As a result of failure of the keyboard controller, which is integrated on the motherboard, the system could not get past its POST routine, and PC Labs could not obtain a 3D WinMark 98 result. The vendor wasn't able to send a replacement unit in time for this review.

Magitronic stocks the unit with a Matrox Millennium II AGP video card, a Creative Labs AWE64 sound adapter, a U.S. Robotics 56.6-Kbps x2 modem, and a speaker and subwoofer set. A game bundle and Lotus SmartSuite are also included.

The G-P2266FM comes with a two-year warranty. Magitronic's toll-free 24-hour, 7-day technical support is available only for one year. A lot is packed into this unit; it may be worth considering.—PN
Magitronic Technology Inc., Norcross, GA; 800-454-8754, 770-447-9454; fax, 770-368-8095; www.magitronic.com. *Circle 468 on reader service card.*

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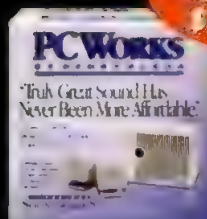
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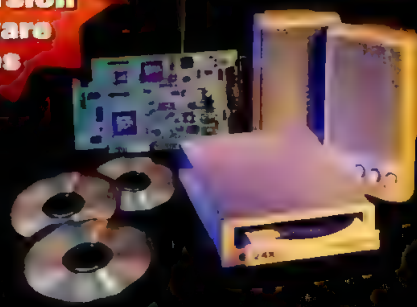
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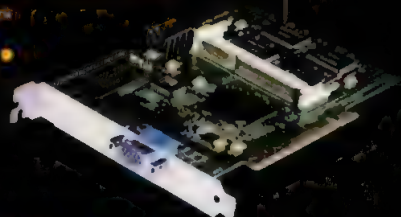


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Mega Impact Pentium II 266 AGP

Pentium II/266, 4.1GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 19.9. \$2,750 street.

With an Intel 440 LX chip set and an ATI 3D Rage Pro AGP graphics accelerator, Mega Computer Systems' Impact Pentium II 266 AGP delivers reliable performance for standard 2-D business applications, which is exactly where it's aimed.

The Quantum Fireball ST Ultra ATA hard disk helped anchor the unit's solid Business Winstone 98 score. Thanks to a 12X/24X Toshiba CD-ROM drive, the unit earned an above-average CD-ROM WinMark 98 score. Because of an improper driver implementation, however, the unit's graphics accelerator could not perform any 3-D rendering in hardware. As a result, its 3D WinMark 98 score was poor.

In case you need to network, the Impact Pentium II includes 3Com's Fast EtherLink XL 10/100 Ethernet adapter. Despite all of the included hardware, this system has plenty of room for expansion. The system comes with a two-year parts-and-labor warranty. No on-site service is included; the technical-support line is toll-free but open only weekdays during business hours. For ready networking and solid 2-D performance, the Impact Pentium II will do the job.—PN

Mega Computer Systems, San Diego; 800-338-6628, 619-487-8888; fax, 619-485-1518; www.megacs.com. *Circle 469 on reader service card.*

MicroFlex-K6/Professional

AMD K6-233, 4.3GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 17.5. \$1,899 direct.

The MicroFlex-K6/Professional from Micro Express may get you asking questions, such as how much the Intel name and that last bit of performance are worth to you. Sidestep those issues and you'll find a hard-working PC for a very good price.

Stray from the Pentium path and performance becomes an issue: The unit's Business Winstone 98 score was near the bottom in this roundup—exactly as expected given the majority field of 266-MHz Pentium II PCs. Its Business Disk Win-

Mark 98 result was average, thanks to an Ultra ATA hard disk, and its CD-ROM WinMark 98 result was above average, courtesy of its 12X/24X Toshiba drive. The normally fast Matrox Millennium II card was hampered by the AMD CPU and turned in a below-average Business Graphics WinMark 98 result. The Matrox card is not adept at 3-D functions, which resulted in a poor 3D WinMark 98 score.

No clutter interferes with upgrades to the mini-ATX motherboard. A Creative Labs AWE64 audio card and a K56flex modem are standard. Round-the-clock, toll-free support and a four-year warranty help make up for the lack of manuals.

Choose the MicroFlex-K6 for value rather than all-out performance.—WLR
Micro Express, Irvine, CA; 800-989-9900, 714-852-1400; fax, 714-852-1225; www.microexpress.net. *Circle 470 on reader service card.*

Micron Millennium XKU

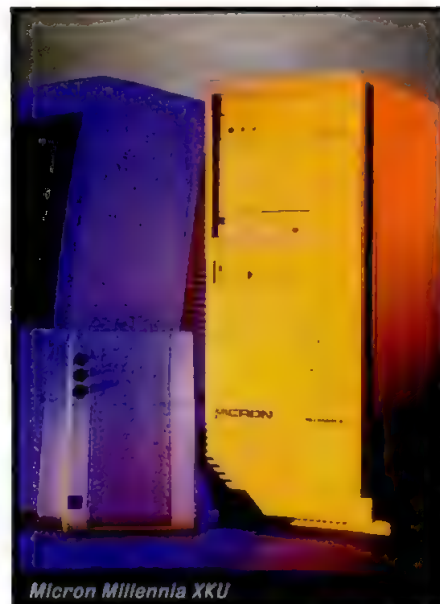
Pentium II/266, 6.2GB hard disk, 19-inch monitor, SDRAM. Business Winstone 98 score: 19.9. \$3,420 direct.

To give the Millennium XKU an edge on the market, Micron Electronics goes a little further by giving you a 19-inch monitor and a Zip drive. You also get good performance, especially in 3-D. You do pay more for those extra components, however.

The unit performed well overall, earning an average Winstone 98 score. The system's Ultra ATA hard disk and 24X Hitachi CD-ROM drive earned it above-average Business Disk WinMark 98 and CD-ROM WinMark 98 scores. The motherboard includes an AGP slot filled with a Diamond Viper V330 graphics board, which delivered a below-average Business Graphics WinMark 98 score but, thanks to the nVidia chip set, yielded a terrific 3D WinMark 98 result.

The system comes with a 56.6-Kbps x2 modem, Yamaha audio with FM synthesis, Advent AV270 speakers and Microsoft Office 97, Small Business Edition.

Micron includes an exemplary instruction manual and has a three-year warranty (five years on the CPU and memory). All told, the Millennium is a premium system that tries to give you the best of everything in one package.—WLR
Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-893-3343; fax, 208-893-



Micron Millennium XKU

7333; www.micronpc.com. *Circle 472 on reader service card.*

Micro X MXP-6100

Pentium II/266, 4.3GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.7. \$2,799 direct.

With the Micro X MXP-6100, Micro X has succeeded in creating an attractive balance of features and cost, topped off by a long warranty. And despite not having all the very latest technology (its 440FX chip set is older, for example), the system provides strong performance.

While most scores were average, the unit's 8MB Matrox Millennium II card helped the unit earn above-average Business Graphics WinMark 98 results. Its 3D WinMark 98 score was low, however.

The system is a breeze to service: The 24X CD-ROM drive and hard disk slide out of their bays, and even the motherboard can be easily removed. The motherboard has a proprietary slot for a DMI card. The card wasn't included, but American Megatrends' DMI Wizard 1.0 software was. Also included was a 33.6-Kbps modem, which will be updated to a K56flex voice modem by press time.

The unit has a five-year-labor, three-year-parts warranty, plus one year's on-site service. Support is available during business hours on weekdays and from 10:00 to 3:30 on Saturdays. If 3-D graphics is not a concern, you can get a good value for your dollar with the MXP-6100.—FJE

Micro X, Solon, OH; 800-736-4276, 216-498-3330; fax, 216-498-3520; www.microx.com. *Circle 471 on reader service card.*



NEC Direction SPL266

NEC Direction SPL266



Pentium II/266, 6.2GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 22.0. \$3,037 direct.

Check the top-performing components in this roundup; the NEC Direction SPL266, one of our Editors' Choice winners, has them all. Targeted at the SOHO and power-user markets, NEC Computer Systems Division's new direct-channel line offers terrific value.

The SPL266 uses an Intel LX chip set, a fast IBM Ultra ATA hard disk, and a Number Nine Revolution 3D AGP graphics card. This combination screams, earning some of the top Business Disk WinMark 98 and Graphics WinMark 98 scores in this roundup—as well as producing the top Business Winstone 98 result. The unit's 3D WinMark 98 score proved the SPL266 is adequate for 3-D tasks.

Among other goodies are Office 97 and a U.S. Robotics 56.6-Kbps x2 modem. The on-board Yamaha audio chip and Altec Lansing ACS45 speakers combine to produce better-than-average audio performance. Designed for easy access, the unit has a single panel that can be removed quickly with one thumbscrew.

Backed by a three-year warranty with one year of on-site service and round-the-clock support, the SPL266 is an easy choice for professionals looking for top performance from a top company.—*BB*
NEC Computer Systems Division, Mountain View, CA; 888-863-2669, 508-264-8000; fax, 508-264-8673; www.nec-computers.com. Circle 473 on reader service card.

NETIS Starburst 266

Pentium II/266, 2.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 19.9. \$2,390 street.

With its older FX chip set, NETIS Technology's Starburst 266 lacks the leading-edge features of the LX chip set, such as the AGP bus. That didn't hurt the performance of this value-priced unit, and for basic office productivity, this system is worth considering.

Most of the Starburst 266's scores on our tests were solidly average, except for below-average Business Disk WinMark 98 and 3D WinMark 98 scores.

Getting the cover off the unit is fairly easy, but memory upgrades could be tough: The SIMM slots are buried under cables and the power supply. Adding other components should not be a problem. The unit also has a 33.6-Kbps fax modem, which can be upgraded to 56.6 Kbps.

The Starburst 266 includes lifetime technical support during business hours, six days a week. Netis covers parts for one year and labor for three years, with the first year of on-site service included. If you need a basic system for the office, the Starburst 266 is a solid choice.—*PN*

NETIS Technology Inc., Milipitas, CA; 800-577-7526, 408-263-0368; fax, 408-263-4624; www.netistech.com. Circle 474 on reader service card.

Nova K6-233

AMD K6/233, 6.1GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 16.3. \$2,899 direct.

Power without pretense is the concept behind the K6-233 from Nova Computers. But the execution is flawed: The K6-233 falls short of Pentium II/266 performance, with some of the poorest test results in this roundup. Even allowing for appealing features such as its DVD drive, Ultra ATA hard disk, 56.6-Kbps x2 modem, and three-year warranty, you'll find better AMD deals—and Pentium II deals—elsewhere.

The Nova unit's K6 CPU could not keep up with its Pentium II-equipped competition, leading to below-average scores on most tests. Despite a Matrox Millennium II graphics card, its Business Graphics WinMark 98 result was below average. The board is not optimized for

3-D functions, which resulted in a very poor 3D WinMark 98 score. The K6-233's Quantum Fireball hard disk delivered an average Business Disk WinMark 98 score.

The Giga-Byte Technology motherboard has two DIMM and four SIMM sockets, but you can't mix memory types. On the plus side, the K6-233 includes a surprisingly good user manual.

Though you could live with some of the K6-233's flaws, you probably won't want to at this price.—*WLR*

Nova Computers Inc., Wickliffe, OH; 800-461-5535, 216-516-3030; fax, 216-516-3040; www.novacompinc.com. Circle 475 on reader service card.

PC Channel/CTX LAK233-32

AMD K6-233, 6GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 15.9. \$1,900 street.

PC Channel/CTX offers its PC Channel LAK233-32 mainly through large resellers like CompUSA and OfficeMax. The system is designed to be a low-cost unit for home or small-business users. While its price certainly meets expectations, and the system will get the job done, true bargain hunters may be more satisfied elsewhere.

Because it uses an AMD K6 CPU while most competing systems here have Pentium II processors, the unit earned below-average Business Winstone 98 and Graphics WinMark 98 scores. Its Matrox Mystique graphics card doesn't support many 3-D functions and led the LAK233-32 to a poor 3D WinMark 98 score. Thanks to its Ultra ATA hard disk, the system earned an average Business Disk WinMark 98 result; its remaining scores were also average.

The unit comes with a Boca K56flex modem and Microsoft Encarta 97, Money, and Works. One minor disappointment: The system's motherboard supports USB ports, but connectors were not installed.

The warranty is limited to one year. Technical support is available on weekdays during business hours. Price is the main reason to consider the LAK233-32—but there are better bargains to be had elsewhere in this roundup.—*FJE*

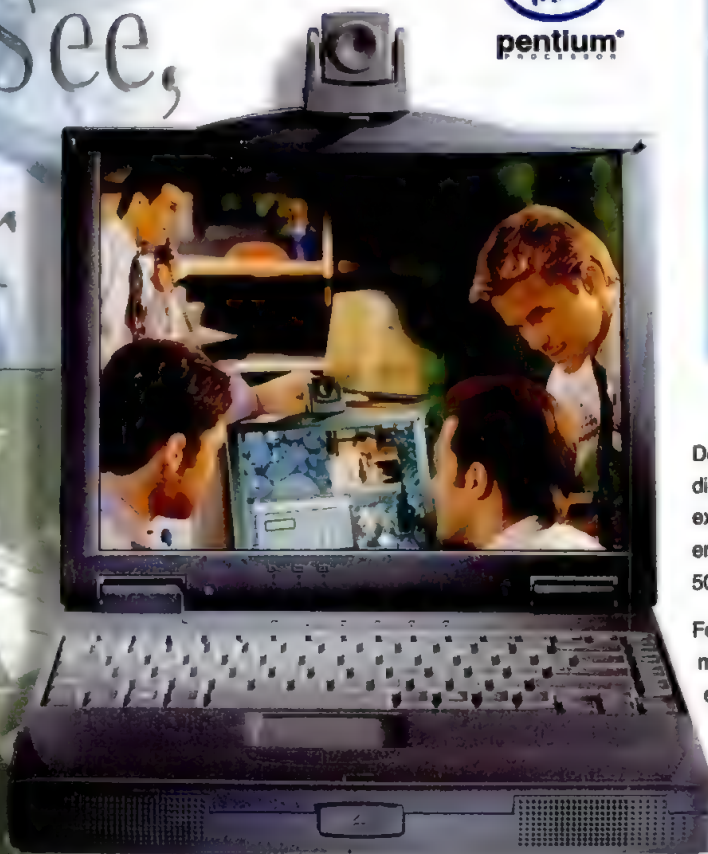
PC Channel/CTX Inc., City of Industry, CA; 626-839-9999; fax, 626-839-9993; www.ctxcomputers.com. Circle 476 on reader service card.

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Premio Apollo FX2 266

Pentium II/266, 4GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.0. \$3,050 street.

Premio Computer's Apollo FX2 266 packs competitive performance as well as good features into its midtower case. Through VARs, the company sells mostly to government and business users.

The unit was an average performer on most of our tests. Its Matrox Millennium II graphics card with 8MB of WRAM garnered the unit an above-average Business Graphics WinMark 98 score but is not as well suited for 3-D, leading to a poor 3D WinMark 98 result. The unit's CD-ROM WinMark 98 score was also below average.

The Apollo FX2 is based on a custom-designed, ATX-like Microstar MS-6109 motherboard. The unit is packed with a 3Com 10/100 network adapter, a Matrox graphics card, a Creative Labs Sound Blaster AWE64 sound board, and a U.S. Robotics Sportster 56.6-Kbps x2 voice modem. One of the PCI slots is blocked by the two USB-port connectors, but you still have two slots for additional expansion.

In case the heavy steel chassis and NetWare certification aren't enough to reassure you, Premio backs the Apollo FX2 with a three-year warranty and lifetime telephone support. On-site service costs \$50 for one year. The system may have limited expansion room, but it already comes with most of what you need.—WLR

Premio Computer Inc., City of Industry, CA; 800-677-6477, 626-333-5121; fax, 626-369-6803; www.premiopc.com. *Circle 478 on reader service card.*

ProGen Polaris 266 W95

Pentium II/266, 6.7GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 20.4. \$2,700 direct.

With a competitive Business Winstone 98 score, a DVD drive, an MPEG-2 decoder and a loud pair of MLI speakers with a subwoofer, ProGen Systems' Polaris 266 W95 more than lives up to its claim to be a professional multimedia PC. This LX/AGP-equipped system's attractive price further sweetens the deal.

The Polaris's test results were mostly average. It had an above-average Business Graphics WinMark 98 score, thanks to its Matrox Millennium II graphics board, but

it had a poor 3D WinMark 98 result.

While its Pioneer DVD-101 DVD drive and Sigma Design RealMagic Hollywood MPEG-2 decoder steal the show, the system also includes a GVC Media Technology SP 802 PCI audio card and an Archtek Smartlink K56flex modem. All these features come at the cost of expansion (there is only one free PCI slot).

The Polaris includes toll-free technical support, but only on weekdays and during business hours. The system also has a three-year-parts, one-year-labor warranty, with on-site service during the first year. If you're looking for strong 2-D performance and a system that's DVD-ready, the ProGen Polaris 266 W95 delivers.—PN

ProGen Systems, Tustin, CA; 800-848-1353, 714-566-9200; fax, 714-566-9267; www.progen.com. *Circle 479 on reader service card.*

Quantex QP6/266 SM-4X

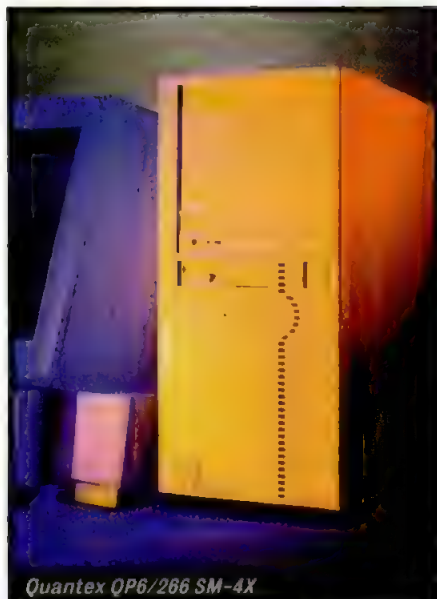
Pentium II/266, 4GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.2. \$2,499 direct.

If you're looking for good performance from a professional PC, then the Quantex QP6/266 SM-4X, from direct vendor Quantex Microsystems, is worth considering.

Using an Ultra ATA hard disk, a Matrox Millennium II graphics card, and 512K of pipeline-burst cache, the system yielded steadily average performance results across the board. The unit's 3-D performance was poor.

Though the hard disk is inaccessible, you'll find a clear path to your processor, memory, and expansion slots, making upgrades easy. The ports on the back are clearly labeled (and include two USB ports). The system also comes with a K56flex voice modem, a pair of Altec Lansing ACS-45W speakers with a subwoofer, and Microsoft Office Small Business Edition 97 and the Microsoft Plus! Pack.

Vendor support consists of a three-year-parts, one-year-labor, and one-year-on-site warranty. Technical support is available round the clock. Appropriate for savvy home or business customers, the Quantex system is a good value.—MJP
Quantex Microsystems Inc., Somerset, NJ; 800-346-6572, 908-563-4166; fax, 908-563-0407; www.quantex.com. *Circle 480 on reader service card.*



Quantex QP6/266 SM-4X

Polywell 7266LX5

Pentium II/266, 6.7GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 20.7. \$2,650 direct.

Polywell Computers' Polywell 7266LX5, intended for graphics professionals, features a large hard disk and AGP graphics as well as good performance in this competitive field. Its reasonable price and generous service and support policies make the 7266LX5 a fine choice.

SDRAM and the LX chip set on the Microstar motherboard helped the 7266LX5 achieve a strong CPU score, and the ATI 3D Xpression PC2TV AGP graphics video card and Fast ATA-2 Maxtor hard disk kept its disk and graphics scores solidly in the average range. As tested, the system was not set up to take full advantage of AGP 3-D capabilities, which led to a poor 3D WinMark 98 score.

The unit is bundled with various Microsoft titles, such as Microsoft Encarta, Entertainment Pack, Money, and Works. A 33.6-Kbps modem is standard (upgradable to K56flex). Sound is provided by a Crystal 3D16 card and QuickShot SF300 speakers.

Polywell provides a three-year-parts, five-year-labor warranty, including on-site service and toll-free 24-hour, 7-day support, both for the first year. The 7266LX's mix of solid performance and attractive price makes it worth a close look.—BB

Polywell Computers Inc., South San Francisco, CA; 800-999-1278, 650-583-7222; fax, 650-583-1974; www.polywell.com. *Circle 477 on reader service card.*

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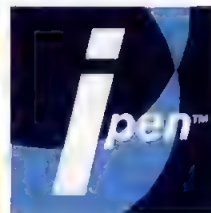
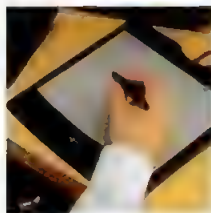
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Professional PCs



Sys Performance Pro 266LA

Royal Synergy Pro

Pentium II/266, 4.9GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.3. \$3,107 direct.

A DVD drive and mostly competitive performance recommend Royal Computer's Royal Synergy Pro, but you may find better value with other systems reviewed here.

Although the Toshiba SD-M1002 DVD drive is alluring, it led to below-average results on our CD-ROM performance tests. The unit's PCI-based ATI 3D Pro Turbo graphics board and Maxtor Ultra ATA hard disk helped the unit to average scores on most of our tests. The ATI card led the unit to a poor 3D WinMark 98 score.

The unit comes with Yamaha OPL3 audio with wavetable and FM synthesis but pairs that with Royal speakers that are inadequate for the DVD-based multimedia system. The unit comes with a U.S. Robotics Sportster 56.6-Kbps x2 modem.

Royal offers a one-year parts-and-labor warranty and toll-free lifetime technical support weekdays and Saturdays for limited hours. On-site service is \$44.95 per year.

The Synergy Pro offers mostly average performance and some good components, but you may find that other systems present a more appealing blend of features—for less money. —WLR

Royal Computer Inc., City of Industry, CA; 800-486-0008, 818-855-5077; fax, 818-330-2717; www.royalcomp.com. *Circle 481 on reader service card.*

SAG PII 266

Pentium II/266, 6.2GB hard disk, 19-inch monitor, EDO DRAM. Business Winstone 98 score:

21.4. \$2,888 direct.

With strong performance, a large monitor and ample expansion space, S.A.G. Electronics' SAG PII 266 deserves serious consideration as a professional PC workhorse. The unit is also network-ready.

Thanks to its Ultra ATA hard disk and Number Nine Revolution 3D graphics card with 8MB of WRAM, the SAG PII 266 yielded above-average scores on our Business Winstone 98, Disk WinMark 98, and Graphics WinMark 98 tests. It produced average scores on our CD-ROM tests and an adequate 3D WinMark 98 result.

The midtower case offers easy access to all components. The unit has an Intel EtherExpress PRO/100B Ethernet card and a Sound Blaster AWE64 wavetable sound board. Also included was an impressive 19-inch Hitachi monitor, which adds a lot of real estate to the on-screen desktop but also occupies a lot of physical desktop.

S.A.G. offers a three-year warranty; 24-hour support will be in place by press time. A year of on-site service costs \$75. With solid performance and components, the SAG PII 266 is a good choice.—RSA

S.A.G. Electronics, North Andover, MA; 800-989-3475, 508-683-0339, fax, 508-689-0180; www.sagelec.com. *Circle 482 on reader service card.*

Seanix CS Power 266

Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.1. \$2,459 direct.

Seanix Technology, the largest computer manufacturer in Canada, has set up shop in the U.S. Its Iowa sales division has put together an attractive system, aimed at home users, in its Seanix CS Power 266. A long warranty period and competitive performance add to the appeal of this system.

The system posted average results on most tests. The Matrox Millennium II graphics card helped the unit achieve an above-average Business Graphics WinMark 98 score, but it produced a poor 3D WinMark 98 score.

This system's home targeting shows in the company's choice of hardware and software. Microsoft Home Essentials 97 and McAfee's VirusScan are bundled with the system. Ensoniq Corp.'s

AudioPCI board and Altec Lansing speakers (with subwoofer) provide clear, full sound. The Motorola K56flex voice modem is handy.

The motherboard, CPU, RAM, and graphics board are covered for five years. Other parts are covered for three years. Technical support is limited to weekday business hours; updated drivers can be found on Seanix's Web page.

For buyers looking for solid performance at a good price, the CS Power 266 may be just the ticket.—FJE

Seanix Technology, Sioux City, IA; 888-252-1190, 712-255-3733; fax, 712-233-3278; www.seanix.com. *Circle 483 on reader service card.*

Sys Performance Pro 266LA

Pentium II/266, 6.4GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 21.7. \$2,694 direct.

Great components configured with care and presented at an appealing price distinguish Sys Technology's Sys Performance Pro 266LA, an impressive PC intended for business and home-based professionals.

The unit ably lived up to its name in testing. The Giga-Byte Technology motherboard with Intel's LX chip set, Number Nine Revolution 3D AGP graphics board with 8MB of WRAM, and IBM Ultra ATA hard disk earned it field-leading scores on our Business Graphics WinMark 98, Business Disk WinMark 98, and Winstone 98 tests. Its 3D WinMark 98 result was adequate.

The system's innards are easy to reach; just remove two screws and take off a single panel. Sys offers no standard software bundles; a U.S. Robotics 56.6-Kbps x2 modem is included.

Sys starts with one-year coverage on labor and all components, and one year's on-site service, with parts warranties good for periods of up to six years, depending on the original manufacturer. Round-the-clock, toll-free support is available for the first year.

Professional power users will find the Sys Performance Pro 266LA a great match for their needs, at a good price.—BB

Sys Technology Inc., Cypress, CA; 800-613-9963, 714-821-3900; fax, 714-821-9592; www.systechology.com. *Circle 484 on reader service card.*

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- Altec Lansing ACS-90 Stereo Speakers
- Intel EtherExpress™ PRO/100 LAN Adapter
- Microsoft® IntelliMouse®
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- Intel® EtherExpress™ PRO/100 LAN Adapter
- Microsoft® IntelliMouse®
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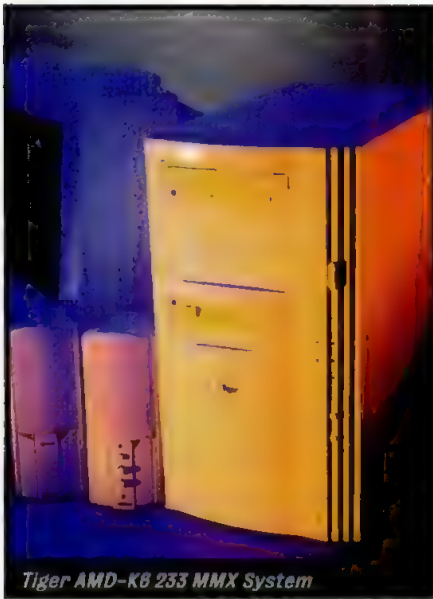
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Tiger AMD-K6 233 MMX System

Tagram Thunderbolt New Generation VII

Pentium II/266, 6.4GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 21.7. \$2,499 direct.

If you're a technology fan, the Thunderbolt New Generation VII, from Tagram System Corp., offers the best of what's new, from the Intel 440LX chip set and AGP to a fast Ultra ATA IBM hard disk and Powercom K56flex modem. Best of all, the new technology isn't expensive.

The unit's Business Winstone 98 result was one of the best in this roundup. In fact, all the Thunderbolt VII's scores were average or above average. Its 3D WinMark 98 score was adequate for basic 3-D functions.

Getting inside the case requires the removal of the front faceplate; you'll find the screws for disassembly behind the plate. We also noticed a flicker in the Tagram-labeled TM-765 monitor (made by Proton) that we received for testing.

Tagram includes DMI software from BCM Advanced Research and a three-year warranty. On-site service and round-the-clock support cost \$65 a year. Otherwise, technical support is available during business hours on weekdays. Overall, the Thunderbolt VII offers an appealing combination of price, performance, and the latest technologies. —WLR

Tagram System Corp., Costa Mesa, CA; 800-824-7267, 714-979-8900; fax, 714-979-8970; www.tagram.com. *Circle 485 on reader service card.*

Tangent Petra II266

Pentium II/266, 4.4GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.1. \$2,895 direct.

If you buy your systems with an eye to future needs, the Tangent Petra II266, from Tangent Computer, could be a perfect fit for you. Not only can you expand the mid-tower system to a full 1GB of EDO DRAM, you can slide in a second 266-MHz Pentium II CPU (a \$699 option). The unit is aimed at business and home markets; its only weakness is graphics performance.

The Intel 440FX-based unit posted average scores on most of our tests. The STB Nitro 3D graphics card could not keep up with the crowd on our Graphics WinMark 98 or 3D WinMark tests, however, pulling the unit's scores below the average.

With standard drives installed—including a Zip drive—you still have four bays for expansion. The Petra II266 also includes a 56.6-Kbps x2 modem, a Creative Labs Sound Blaster AWE64 board, and Altec Lansing ACS45 speakers.

Substitute another graphics board and you'll have a machine you won't soon outgrow—at least not within its three-year warranty period (which includes one year of on-site service). Lifetime toll-free technical support is available for limited hours, six days a week. —WLR

Tangent Computer Inc., Burlingame, CA; 888-826-4368, 415-342-9388; fax, 415-342-9380; www.tangent.com. *Circle 486 on reader service card.*

Tempest 3D-128 Pro

Pentium II/266, 3.1GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 20.3. \$2,498 direct.

Tempest Micro's Tempest 3D-128 Pro has a tempting price and offers adequate performance, but it runs into stiff competition from other systems in this roundup that offer better value for the same price.

Most of this 440FX-based system's benchmark test scores were average, with above-average marks on the Business Graphics WinMark 98 and CD-ROM WinMark 98 tests. The unit performed poorly on our 3D WinMark 98 tests.

In our test unit, the motherboard connections interfere with full-length expansion boards in some slots. And the manufacturer forgot to punch holes for the twin

USB ports; the jacks are on the motherboard, but you can't plug into them. Although the company says new systems will be properly set, the omission may make you think twice about Tempest's quality control.

The unit also comes with a K56flex modem and a Creative Labs Sound Blaster AWE64 audio board. Tempest backs it with a one-year warranty.

If you're experienced and can deal with the rough edges, the 3D-128 Pro may be worth a look. —WLR

Tempest Micro, Walnut, CA; 800-818-5163, 909-595-0550; fax, 909-595-5425. *Circle 487 on reader service card.*

Tiger AMD-K6 233 MMX System

AMD K6-233, 4.1GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 15.1. \$1,695.99 direct.

If cost is your most important consideration, TigerDirect's Tiger AMD-K6 233 MMX System may be for you. It boasts this roundup's lowest price, but the savings are reflected in its below-average performance.

The 233-MHz, AMD K6-based system does not compare well with machines based on Intel's 266-MHz Pentium II processor; this unit finished dead last or near the bottom on most of our benchmark tests. The unit's Matrox Mystique graphics card does not support many 3-D features and led the unit to a poor 3D WinMark 98 score.

This unit is not without its charms, however. The Apollo II-based FIC motherboard doesn't offer the performance advantages of Intel's LX chip set, but it is extremely versatile: You can add memory via DIMM or SIMM sockets, and there's plenty of room for ISA-based add-ons. The unit uses IBM's all-in-one MWave 33.6-Kbps voice modem (upgradable to 56.6 Kbps) and sound card, which has wavetable synthesis, and it comes with Yamaha speakers.

The system has a one-year warranty that includes a year of on-site service. Technical support is available during extended business hours, six days. If you're looking for a bargain-priced basic system, consider the AMD-K6 233 MMX. —JAH
TigerDirect Inc., Miami; 800-830-0056, 305-229-1119; fax, 305-228-3400; www.tigerdirect.com. *Circle 488 on reader service card.*

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UmaxStation 6000

Pentium II/266, 3.8GB hard disk, 17-inch monitor, EDO DRAM. Business Winstone 98 score: 18.1. \$3,295 direct.

The UmaxStation 6000, from UMAX Technologies, throws in a lot of hardware and software for its price. But though the machine can handle most chores well, it earns no raves for graphics performance when compared with other professional PCs in this roundup.

The system garnered mostly average scores on our tests. The Matrox Millennium graphics board contributed to the unit's below-average results on our Business Graphics WinMark 98 and 3D WinMark 98 tests.

Two 5.25-inch drive bays allow expansion beyond the four included drives (floppy disk drive, 3.7GB hard disk, 24X CD-ROM drive, and Zip drive). Sound—a Creative Labs Vibra 16C system—is built into the Asus KN97-X1440FX motherboard. Extra accessories and a three-year warranty that includes a year of on-site service add value to the package. The accessories consist of a 10/100Base-T adapter and a wealth of software (an Adobe graphics bundle: PageMill, PhotoDeluxe, and Type Manager).

Although the UmaxStation 6000 is not a leading graphics powerhouse, once you take into account its added features, it is a contender.—WLR

UMAX Technologies Inc., Fremont, CA; 888-289-8629, 408-735-0200; www.umaxpc.com. Circle 489 on reader service card.

Unicent Avanta 266XLP

Pentium II/266, 4.1GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 19.9. \$2,899 direct.

Direct vendor Unicent Technologies puts together a good all-around package with its Avanta 266XLP. Unicent aims this system at the corporate and high-end graphics markets, but the unit would be appropriate for SOHO users as well.

The 266XLP features a 440LX chip set and AGP support, and it was a mostly average performer except for an above-average Graphics WinMark 98 result and a below-average CD-ROM WinMark 98 score. Its Matrox Millennium II graphics card with 8MB of WRAM earned the unit a poor score on our 3D WinMark 98 tests.

The well-organized interior of the system facilitates upgrades. The front-mounted hard disk has a snap-button release. The side panel of the chassis can be removed by means of a single thumbscrew.

The system comes with Microsoft Office 97 Professional Edition, a U.S. Robotics 56.6-Kbps x2 voice modem, and Premier SW32 speakers. As an added bonus, there's a Toshiba DVD-ROM drive as well. Unicent backs its product with a five-year-parts, three-year-labor warranty, with one year of on-site service. Toll-free 24-hour, 7-day technical support is available.

Thoughtful features and a strong warranty recommend the 266XLP.—MJP
Unicent Technologies, Aurora, OH; 800-731-6526, 216-344-2649; fax, 216-344-2655; www.unicent.com. Circle 490 on reader service card.

Vektron Vision2-266

Pentium II/266, 6.1GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 20.6. \$2,795 direct.

The Vektron Vision2-266 offers fast performance at a palatable price point for professional users. With average or above-average scores on all tests and very high graphics results, Vektron's system is a good fit for business and home users.

The Vision2-266's LX chip set, SDRAM, and Matrox Millennium II AGP graphics video card with 6MB of WRAM helped the unit earn a strong Business Winstone 98 result and an above-average Business Graphics WinMark 98 score. The Matrox board contributed to a poor 3D

WinMark 98 result for the Vision2-266.

Buyers will be set for sound with the bundled Sound Blaster AWE64 Gold board and Altec Lansing ACS45 speakers. A U.S. Robotics 56.6-Kbps x2 modem is also included. The system's software consists of two games, part of an expansion card bundle. The specific games may vary, so if that's an important consideration for you, be sure to ask.

Vektron's computers are covered by a one-year warranty with on-site service included and toll-free technical support round the clock. The Vektron Vision2-266 is a solid buy at a fair price.—BB
Vektron, Grand Prairie, TX; 800-725-0020, 972-606-0280; fax, 972-606-1278; www.veptron.com. Circle 491 on reader service card.

Xi 532GP Mtower

Pentium II/266, 6.4GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98 score: 2.1. \$3,049 direct.

Aimed at high-end corporate and graphics buyers as well as CAD professional, the Xi 532GP Mtower, from Xi Computer Systems, offers an appropriately above-average Business Graphics WinMark 98 score and competitive performance on the rest of our tests.

The Xi 532GP's Number Nine Revolution 3D graphics card with 8MB of WRAM is the driving force behind the unit's exemplary 2-D graphics performance; its 3-D score was adequate. The system, based on Intel's older 440FX chip set, also comes with a U.S. Robotics 56.6-Kbps x2 voice modem and a set of Altec Lansing ACS-45W speakers (with subwoofer).

The case features a sliding door (not lockable) that covers the power switch and front drive bays. The expansion slots are easily accessible, but the memory slots and hard disk are hard to reach. The system included the LM78 ASIC, a hardware-monitoring chip.

Service offerings include a three-year-parts-and-labor, one-year-on-site warranty; technical support is toll-free and available round the clock. Besides comprehensive support, you'll get strong graphics with this unit and good peripherals as well.—MJP

Xi Computer Systems, San Clemente, CA; 800-432-0486, 714-498-0858; fax, 714-492-6571; www.xicomputer.com. Circle 492 on reader service card. PC

MANAGED CORPORATE PCs



We tested 45 managed corporate PCs arranged in two groups: 27 mainstream, Pentium MMX-class Windows 95-based systems and 18 high-end Pentium II-class Windows NT units. All sup-

port DMI 2.0 and offer software management solutions—in most cases Intel LANDesk 3.0—but not all solutions are created equal.

You'll find lots of differences in the amount of information each system can report and in what can be done remotely.

The best systems offer easy-to-service chassis, a complete inventory of system information, Wake-on-LAN capabilities, hardware monitoring, chassis intrusion alarms, and in a few cases, even remote BIOS updates.

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• High-End: Compaq Deskpro 4000
6266X/3200/CDS

• Mainstream: IBM PC 300PL

In the managed corporate market, manageability—full asset tracking, remote-management capability, and easy-to-service

design—not performance—are paramount.

Both the \$2,950 high-end Compaq system and the \$2,650 mainstream IBM PC offer complete management solutions, ranging from hardware-monitoring chips and tool-free chassis design to some of the best in desktop management software. Through Compaq's Intelligent Manageability and IBM's combination of NetFinity, Intel's LANDesk 3.0, and LANClient Control Manager software, administrators can inventory practically any component of the PC, upgrade the BIOS remotely, and detect chassis intrusion, high temperatures or high voltages, and component failures. They can even lock components from the management console. Both systems also have Wake-on-LAN and remote power-on and off.

It may be relatively high-priced for a mainstream unit (average price for this group is about \$2,200), but the IBM desktop design is easier to manage and allows easy removal of the motherboard. IBM also brands serial information on key components and tracks them. Both companies offer excellent warranties and around-the-clock technical support. Compaq supplements this with its prefailure warranty, using technology that monitors the hard

disk and memory so that faulty equipment can be replaced before failure occurs. Look for more vendors to implement this in the future. IBM PCs have SMART hard disks.

IBM was just one of two vendors to earn above-average marks across the board on our 1997 Service and Reliability survey. Dell was the other, and Compaq did nearly as well, earning above-average scores on three of our four most significant categories, with one average result.

The two Dell OptiPlex systems earn an honorable mention on the basis of their chassis design. Both are an administrator's dream, providing tool-free cases and then going beyond. Dell Inspector—Dell's DMI management software—is also a good package, providing full system information.

Both of Hewlett-Packard's Kayak XAs also earn an honorable mention for their excellent management software, HP TopTools. The HP systems have the same remote-management capabilities as those of Compaq and IBM, as well as a tool-free chassis. We saw early models of the Kayaks; once HP implements hardware monitoring (which should be in place on the high-end unit by the time you read this) as well other planned upgrades, the units will be the equal of the best systems here.



Compaq Deskpro 4000 6266X/3200/CDS

AcerPower Network Ready

Pentium MMX/166, 3.1GB hard disk, 15-inch monitor, EDO DRAM. Business Winstone 98: 14.0. \$1,100 street.

Acer America Corp.'s AcerPower Network Ready offers an easy-access chassis and useful software, but it lacks the LM78 chip (or equivalent) hardware monitor for temperature, fan, and motherboard voltage alerts. Its performance was mostly below average for its corporate mainstream class. Given its price, however, it's worth a very close look.

Late this year, Acer will introduce a new line of managed AcerPower PCs, which will be offered both with Pentium MMX and Pentium II CPUs.

The unit comes with a 3Com 10/100 network card and Intel's LANDesk Client Manager 3.1, which can provide a full accounting of the unit's hardware. The system could not take complete advantage of this software, however, because its motherboard lacks a hardware monitor chip. All AcerPower Network Ready units come with a hard disk recovery CD-ROM; our test unit came with a SMART hard disk that can monitor itself and report problems before failure occurs.

The slim desktop case opens easily and offers clear access to the Acer motherboard, which has an Intel 430HX PCI chip set as opposed to the more recent 430TX. Removing two screws allows for easy extraction of the floppy and hard disk drives. In terms of expansion, you'll find one 3.5-inch drive bay is open, and three expansion slots are available.

The unit's CPU and ATI Mach64 graphics chip set could not keep up with others in its class, leading to below-average scores on Business Winstone and Graphics WinMark 98; Disk and CD-

ROM WinMark 98 scores were average.

The system comes with a three-year warranty and a year of on-site service. Low price and an easy-access case recommend it, but performance and some management features are lacking.—Robert S. Anthony

Acer America Corp., San Jose, CA; 800-733-2237; 408-432-6200; fax, 800-554-2494; www.acer.com. Circle 442 on reader service card.

Advanced Megatrends Apollo 266PII-D, Apollo 233M5

Apollo 266PII-D: Pentium II/266, 6GB hard disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 27.7. \$2,899 direct.

Apollo 233M5: Pentium MMX/233, 6GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 17.7. \$2,499 direct.

Advanced Megatrends Microsystems' Apollo 266PII-D high-end PC and Apollo 233M5 mainstream corporate PC both offer adequate performance and reasonable DMI. The units came with impressive storage systems that included Promise Ultra ATA hard disk controllers and 6.4GB Quantum Ultra ATA hard disks. But now that the vendor offers systems with the LX chip set, the Promise controller is no longer necessary and will not be standard.

Both units also offer Intel EtherExpress Pro/100B Ethernet cards and Intel's LANDesk 3.0 DMI browser software, which browsed most components in the 233M5 and was able to identify all components in the 266PII-D. The 266PII-D came in a tall tower case with seven open drive bays and a dual Pentium II—capable Super Micro motherboard. The unit features six thermally controlled variable-speed cooling fans and a proprietary DMI board that supports thermal and chassis intrusion alarms. The 233M5 midtower's well-finished interior offers clear access to the Super Micro motherboard, which includes the LM78 hardware monitor chip. The Apollo 233M5 also came with an internal 100MB Iomega Zip Drive.

The 233M5 yielded an above-average

Business Graphics WinMark 98 score for its class and posted average scores on the rest of our tests. Within its class of high-end corporate PCs, the 266PII-D posted average scores on all of our tests.

Both units used a Matrox Millennium II graphics card and a Creative Labs Sound Blaster AWE32 sound board. The two systems are also bundled with Microsoft Office 97 Professional Edition.

Advanced Megatrends offers a three-year parts and one-year labor warranty with 24-hour technical support and a year of on-site service. Its Web site offers BIOS upgrades and mostly motherboard-related help files. With adequate performance and DMI features, both units are reasonable choices, although the Apollo 266PII-D fared better with LANDesk.—RSA

Advanced Megatrends Microsystems, Warwick, RI; 800-495-2955, 401-737-3859; www.advancedmegatrends.com. Circle 493 on reader service card.

Compaq Deskpro 4000 6266X/3200/CDS, Deskpro 4000 5233X/3200/CDS



Deskpro 4000 6266X/3200/CDS: Pentium II/266, 3GB hard disk, 15-inch monitor, SDRAM. High-End Winstone 98: 25.7. \$2,950 street.

Deskpro 4000 5233X/3200/CDS: Pentium MMX/233, 3GB hard disk, 15-inch monitor, SDRAM. Business

Winstone 98: 16.9. \$2,220 street.

Compaq showcases its top-notch home-grown PC management technology in both its Deskpro 4000 6266X/3200/CDS high-end corporate unit (one of our Editors' Choice winners) and its Deskpro 4000 5233X/3200/CDS mainstream corporate PC. Through Compaq's Insight Manager software, the units provide the standard browsing and monitoring features found in most managed PCs—but then go beyond, offering one of the most complete sets of remote-management features around.

A set of remote-configuration commands, such as wake up, flash the BIOS and then shut down can be saved as a file and then remotely sent to these Deskpro units on a network. The mainstream unit uses the LM75 ASIC to monitor temperature, and the high-end unit has a TC621 hardware monitor chip for such functions.

Managed Corporate PCs

Various components on each unit, such as the floppy disk drive, I/O ports, and network controllers can be disabled remotely with a flash of the CMOS settings.

The units come in easy-open desktop cases with intrusion alarms, and electric cover locks can be triggered remotely. Inside, most components can be removed easily, and the memory and expansion slots (the latter are on risers) are readily accessible. Both units use Compaq motherboards with integrated features such as a 10/100 Ethernet adapter, a jack for an external IR transceiver, and a 16-bit audio subsystem.

The 5233X posted average scores on all tests. The 6266X, helped by its 66-MHz AGP bus, posted one of this roundup's best High-End Graphics WinMark 98 scores. Its High-End Winstone 98 score was average, but its CD-ROM WinMark 98 and High-End Disk WinMark 98 scores were below average.

The units have a three-year parts, one-year labor warranty with a year of on-site service. Compaq units can predict failure of either the hard disk (by monitoring bad sectors) or memory (by keeping track of ECC errors), which Compaq will then replace under its prefailure warranty. The company also offers 24-hour technical support, and its Web site has a large library of support documentation and software. Both Deskpros offer excellent management capabilities and easy-to-service chassis; they're great corporate buys.—**RSA Compaq Computer Corp.**, Houston, TX; 800-345-1518, 281-370-0670; fax, 281-518-1442; www.compaq.com.

Comtrade Corporate PC

Pentium MMX/233, 6.4GB hard disk, 15-inch monitor, SDRAM. Business Winstone: 16.8. \$2,125 direct.

Comtrade does a nice job of balancing price and features in its mainstream Corporate PC, which offers mostly average performance except for above-average CD-ROM scores. Its management features are adequate.

The tested unit came with an Intel EtherExpress Pro/100 TX card and Intel's LANdesk 3.0 DMI software. Sensors notify users of fan malfunctions and overheating, but not of chassis intrusion. Because only one of the Comtrade's three sockets for DIMMs are filled, you have plenty of upgrade room, but access is a bit

difficult with the drive bays blocking the memory and the CPU. The motherboard slides out of the back of the system so that access to the cards and the drive bays is unhindered, however.

Major components, including the Intel 430TX-based motherboard, are from top-tier vendors. Users can begin working quickly because Comtrade bundles Lotus SmartSuite 97. The included Diamond graphics card supports 3-D features. The bundled 56.6-Kbps U.S. Robotics x2 modem and the speakers—with subwoofer—are nice extras but may be more appreciated in a SOHO setting.

The Corporate PC comes with a three-year parts and one-year labor warranty. On-site service costs \$25 for the first year. Technical support is available during extended business hours on weekdays and from 8:00 to 5:00 Saturdays.

This is a fine general-business system, offering good basic management features.—**Frank J. Evans**

Comtrade Inc., City of Industry, CA; 800-969-2123, 626-961-6688; fax, 626-369-1479; www.comtrade.com. *Circle 449 on reader service card.*

Dell OptiPlex GXa, Gn+

OptiPlex GXa: Pentium II/266, 3.2GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98: 26.7. \$3,240 direct.

OptiPlex Gn+: Pentium MMX/233, 3.2GB hard disk, 15-inch monitor, EDO DRAM. Business Winstone 98: 15.6. \$2,307 direct.

Unlike many of the DMI-compliant machines in this roundup, the two additions to Dell's OptiPlex line of networked corporate systems—the GXa and the Gn+—are specifically designed and marketed as managed PCs. These machines have two of the most accessible chassis designs available and ship standard with Dell Inspector, a DMI 2.0-compliant software package that, like Intel LANdesk, can monitor a system's hardware and software configurations locally or remotely.

Dell Inspector has two separate interfaces for viewing system data. A General Overview screen displays your PC's most relevant characteristics (such as CPU, BIOS, installed software, and so forth) from an easy-to-use GUI, whereas a System Details screen lists a more granular data set within a traditional DMI tree structure. Inspector cannot identify high



voltage levels, high temperatures, or chassis intrusions. The GXa, however, automatically saves all data and shuts down in the event of a fan failure.

Only your hands are needed to remove the Gn+ slimline's plastic cover and some internal components. Inside are several free expansion slots and two free IRQs, but all the drive bays are occupied. The motherboard integrates S3 Trio graphics and a 3Com 10/100 NIC. The Gn+ performed poorly on our CPUmark₃₂ and Graphics WinMark 98 tests because of its 256K of L2 cache (all but one other tested unit had 512K) and S3 graphics chip set, respectively. Other scores were average.

The mini-tower GXa is just as accessible as its sibling. You remove the cover, CD-ROM drive, and floppy disk drive without tools, and the internal drive bay cage and the power supply swing out on hinges to expose the motherboard—which integrates audio, a 3Com 10/100 NIC, and ATI AGP graphics. The GXa also has plenty of expansion room and six free IRQs.

Since the ATI graphics subsystem could not keep up with the others in this roundup, the unit had a low Graphics WinMark 98 score. Other scores were average.

Both systems include Altec Lansing speakers and have a three-year parts, one-year labor warranty with on-site service. Dell has fashioned two adept and user-friendly managed PCs. Minor performance problems and lack of an DMI ASIC should not deter serious corporate buyers.—**CM Dell Computer Corp.**, Round Rock, TX; 800-289-3355, 512-338-4400; fax, 512-728-3653; www.dell.com. *Circle 451 on reader service card.*

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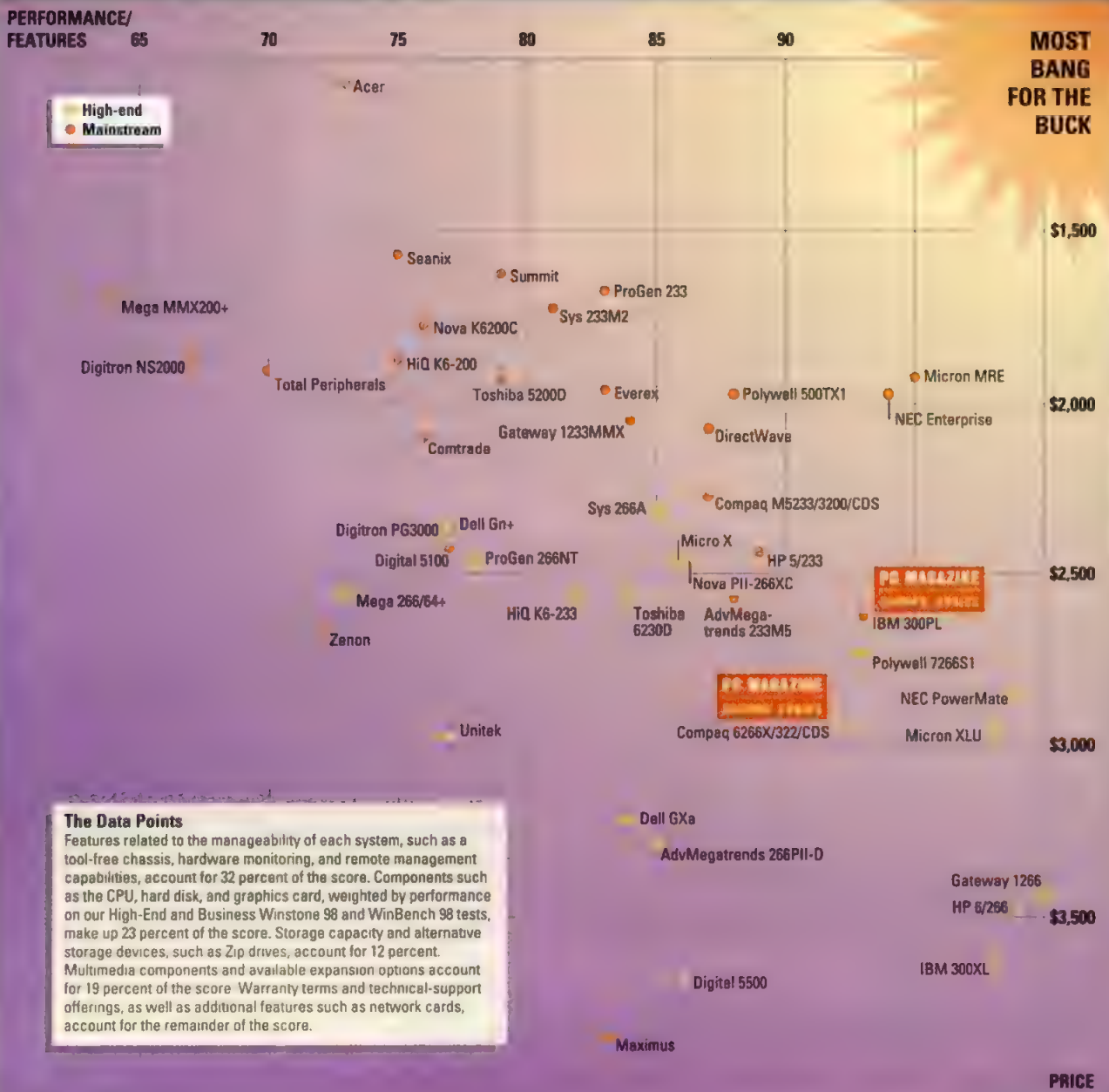
Price/performance index: managed corporate PCs

The mainstream Micron Client-Pro MRE and NEC Enterprise Series Managed PC offer a good balance of performance, features, and price. The Managed PC (\$2,000 street) has an easy-to-service case filled with quality hardware that produced above-average ZD Business Winstone 98, Business Disk WinMark 98, and Business Graphics WinMark 98

scores. The MRE (\$1,949 direct) has average performance, highlighted by a top CD-ROM WinMark 98 score, and one of the roundup's longest warranty periods. Both units have well-implemented LANdesk management solutions with Wake-on-LAN support.

Our two Editors' Choices, the high-end Compaq Deskpro 4000 6266X/3200/CDS (\$2,950 street) and the main-

stream IBM PC 300PL (\$2,650 street), offer average performance and top-notch management solutions (Compaq through its Intelligent Manageability and IBM with a combination of LANdesk, IBM Netfinity, and IBM LAN-Client Control Manager). Both provide all standard management features and more, with support for remote BIOS upgrades and remote component locking.



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BENCHMARK TESTS

Managed Corporate PCs



There's more to managed PCs than performance. But when speed counts, the high-end entries from Gateway 2000 and Sys Technology, as well as the mainstream offerings from NEC and Sys, lead the way.

What the Numbers Mean

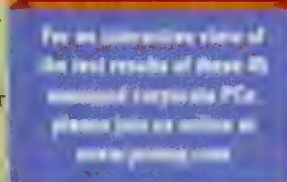
We classified the corporate PCs in this review in two groups: mainstream and high-end systems. The mainstream business machines run Windows 95 on an Intel Pentium MMX, Cyrix 6x86MX PR-233, or AMD K6/200 processor with 32MB of RAM; they have a graphics card with 2MB or more video memory and a 3GB or larger

hard disk. The high-end PCs are Windows NT 4.0 machines powered by Intel Pentium II or AMD K6/233 processors and packed with 64MB of RAM, a graphics subsystem with 4MB or more of memory, and a 3GB or larger hard disk.

We expect the mainstream corporate PCs to run primarily office applications. The high-end PCs will often run more advanced software—for professional graphics, for example—as well as typical business applications. Accordingly, we ran the ZD Business benchmark tests (Winstone 98 and WinBench 98) on the mainstream PCs, and both the ZD High-End and ZD Business benchmark tests on the high-end systems. Based on the required graphics memory size, we set the mainstream PCs to 1,024-by-768 with 64K colors and the high-end PCs to 1,024-by-768 in true-color mode. Few business applications currently take advantage of 3-D capabilities, and the entertainment

applications which do stress 3-D heavily are not meant for the corporate market; therefore, we chose not to run 3D WinBench 98 on either group of managed corporate PCs.

www.pcsmag.com



ZD Business Winstone 98
Business Winstone 98 measures the unit's performance running four categories of applications found in corporate offices—database/spreadsheet, word processing, publishing, and Web browser. We report only the overall Winstone 98 result.

In the mainstream class, the entries from DirectWave, NEC, and Sys Technologies garnered the top three scores. The best score came from the Sys Technologies' Performance 233M2, the only Cyrix 6x86MX-233-based unit here. Fast supporting hardware such as IBM's Deskstar 5 Ultra ATA hard disk and Number Nine's Revolution 3D graphics card gave rise to

▲ High scores are best.
▼ Low scores are best.
Bold type denotes first place.

**ZD High-End
Winstone 98**
Score

**ZD High-End
Graphics
WinMark 98**
24-bit score

**ZD High-End
Graphics
WinMark 98**
32-bit score

**ZD High-End
Disk WinMark 98**
Thousands of bytes per second

**ZD Business
Winstone 98**
Score

HIGH-END

	ZD High-End Winstone 98	ZD High-End Graphics WinMark 98	ZD High-End Graphics WinMark 98	ZD High-End Disk WinMark 98	ZD Business Winstone 98
Advanced Megatrends Apollo 266PII D 27.7	147	124	3,210	26.1	
Compaq Deskpro 4000 M6266X/3200/CDS 25.7	152	148	2,000	25.9	
Dell OptiPlex GXa 26.7	N/A	94	3,300	22.3	
Digital PC 5500 6266 28.5	147	N/A	3,430	26.7	
Digitron Micro Solution PG3000 27.3	149	126	2,940	26.1	
Gateway E-3100-1266 30.52	N/A	137	3,350	27.2	
HP Kayak XA 6/266 PC Workstation 26.2	118	87	2,920	22.0	
HiQ K6-233 HPC 21.4	101	93	3,280	21.9	
IBM PC 300XL 27.9	132	126	2,920	25.1	
Mega Impact PentiumII266/64+ 28.4	148	N/A	3,030	26.2	
Micron Client Pro XLU 25.6	117	N/A	2,000	24.9	
NEC PowerMate Professional 27.3	N/A	141	2,470	26.4	
Nova PII-266XC 27.3	148	N/A	2,970	25.5	
Polywell Poly 7266S1 28.1	153	144	3,050	27.7	
ProGen Polaris 266NT 26.8	149	125	2,990	25.8	
Sys Performance Pro 266A 28.7	N/A	140	3,580	27.2	
Toshiba Equium 6230D 25.1	115	90	2,790	23.5	
Unitek UT-PII266 Provider 27.1	149	126	2,770	25.9	
	BETTER ▶	BETTER ▶	BETTER ▶	BETTER ▶	BETTER ▶

BETTER ►

BETTER ►

BETTER ►

BETTER ►

BETTER ►

(1) With an Action, MPEG 1, 352 by 240, 30 fps, 300 KBps clip. (2) We tested at 32-bit color depth, because this unit does not support 24-bit color. N/A—Not applicable. The product does not support the tested color depth.

the top performers. Use of speedier SDRAM over EDO DRAM was another major contributor to good performance in this category. We also saw three systems with AMD's K6/200 processor. Three of these machines performed above the mean but were not in the top tier.

The high-end category consisted predominantly of Pentium-II/266-based systems. Of these, the Gateway E-3100-1266, the Polywell Poly 7266S1, and the Sys Performance Pro 266A performed above the rest. In this case, the systems with top scores were helped by Maxtor's 85120A8 ATA-3 hard disk and the Matrox Millennium II graphics card. The lone AMD K6/233 machine, the HiQ K6-233 HPC, was severely outclassed in the Windows NT environment where K6 processors are not as adept as Pentium II CPUs. In the professional/enthusiast side of this story, we saw a clear pattern: Systems with Intel's latest chip set, the 440LX, had better scores. In the managed corporate category, however, the Intel 440LX chip set's benefit to the overall system performance in the NT setting is inconclusive based on our data.

ZD High-End Winstone 98 ZD High-End

Winstone 98 uses computation-intensive applications that include more floating-point calculations and exercise the CPU, graphics, and disk subsystems more heavily than ZD Business Winstone 98.

Gateway's E-3100-1266 high-end machine with its fast IBM Deskstar 5 disk subsystem and the AccelGraphics AccelStar 8 3D AGP card was the clear winner on the High-End Winstone test, with a score of 30.5. The bottom slot is occupied by the HiQ unit, whose AMD K6/233 processor was capable of achieving a High-End Winstone score of only 21.3 under Windows NT 4.0.

ZD CPUmark₃₂ ZD CPUmark₃₂ isolates the performance of a system's processor subsystem, which consists of system memory, L2 cache, and most importantly, the CPU itself. We no longer report 16-bit performance because today's business applications predominantly use 32-bit instructions and addressing.

Intel's Pentium MMX/233 is the most prevalent processor in the mainstream category, but the fastest processors were the AMD K6/200 and Cyrix 6X86MX PR-233—13 percent and 7 percent faster,

respectively, than the Pentium MMX/233. Together with the Business Winstone results, our data on CPUs makes a strong case for the non-Intel processors when it comes to running business applications under Windows 95. According to our data, motherboards also play a performance role: Several systems chose the ASUS/tek TX97-X motherboard for its DMI features, but this motherboard also seems conducive to good CPU performance since all of the top six CPUmark₃₂ performers used it. As expected, SDRAM showed clear advantage over EDO DRAM: All but 2 of the 14 best CPU scores were posted by SDRAM-based PCs.

In the high-end category, there was one notable result: An exceptional score by ProGen's Polaris 266NT with a SuperMicro P6SNE II motherboard. Although motherboard chip sets do affect performance, we saw no significant differences among scores of systems using the 440LX and 440FX chip sets on this test.

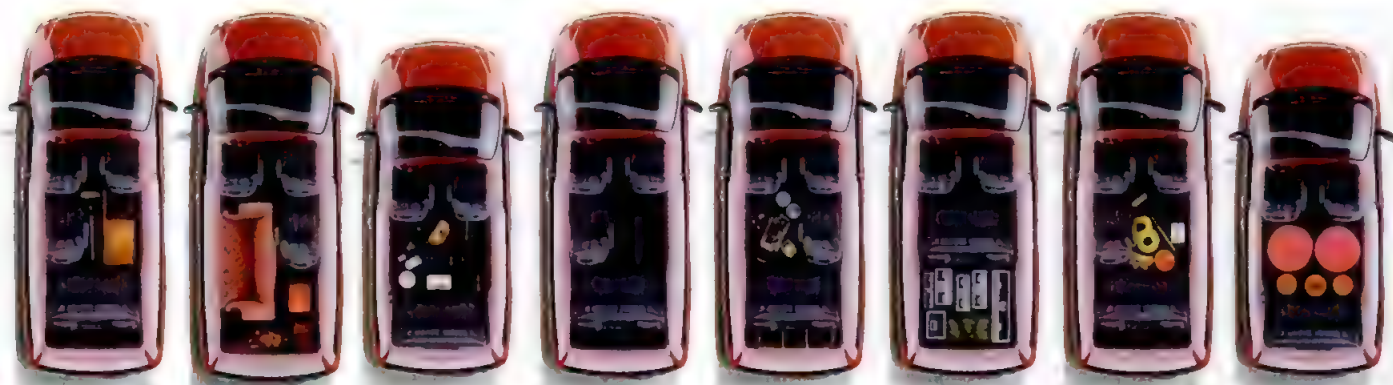
ZD Business Graphics WinMark 98 and ZD High-End Graphics WinMark 98 The Business Graphics WinMark models the graphic subsystem's performance in dis-

		CD-ROM					Full-Screen Scaling ¹		
ZD Business Graphics WinMark 98 24-bit score	ZD Business Graphics WinMark 98 32-bit score	ZD Business Disk WinMark 98 Thousands of bytes per second	ZD CPUmark ₃₂ Score ▲	ZD CD-ROM WinMark 98 Score ▲	Access Time (milliseconds) ▼	CPU Utilization (percent) ▼	Transfer Rate: Inside (thousands of bytes per second) ▲	CPU Utilization (percent) ▼	Maximum Frame Rate (frames per second) ▲
130	75	1,480	668	1,490	92	74	1,800	98	18.3
141	131	1,120	683	1,170	98	79	1,780	97	18.7
N/A	64	1,320	693	1,490	114	4	2,040	43	72.6
127	N/A	1,460	686	1,370	103	90	2,010	96	18.3
132	75	1,260	690	1,340	125	52	1,810	97	19.2
N/A	129	1,550	691	1,340	124	3	1,820	97	6.8
82	47	1,290	691	1,530	91	3	1,800	98	23.0
102	71	1,370	559	1,530	106	48	2,010	96	16.8
113	125	1,400	690	1,330	119	4	1,580	97	20.1
134	N/A	1,280	684	1,730	97	62	2,180	97	19.2
93	N/A	1,290	692	1,630	80	53	1,880	55	56.8
N/A	131	1,350	686	1,250	115	52	1,840	93	29.8
131	N/A	1,310	687	1,340	125	52	1,820	97	19.2
135	126	1,510	689	1,550	103	4	2,000	95	20.0
137	76	1,310	718	1,540	102	57	2,010	95	19.0
N/A	129	1,500	691	1,570	101	3	2,020	80	30.7
93	88	1,260	606	1,710	94	64	2,100	98	8.6
131	75	1,260	692	1,350	123	52	1,820	99	19.2
BETTER ►	BETTER ►	BETTER ►							

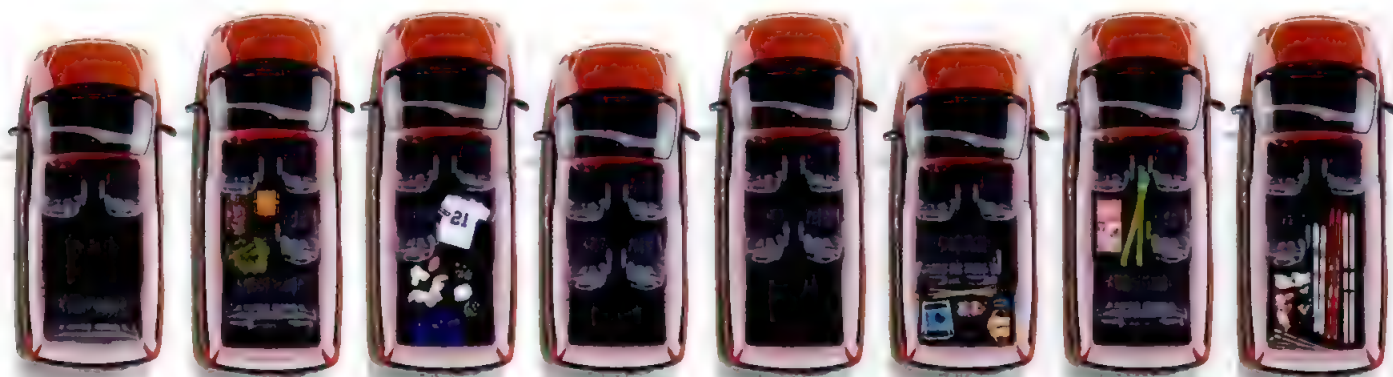
Go configure.



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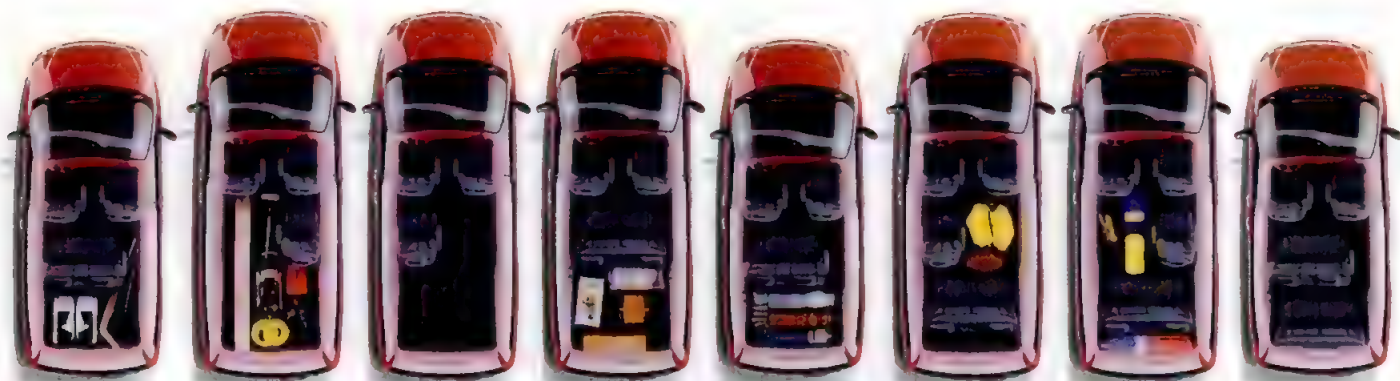
a variety of configurations is an exercise in convenience, not an exercise in...well...



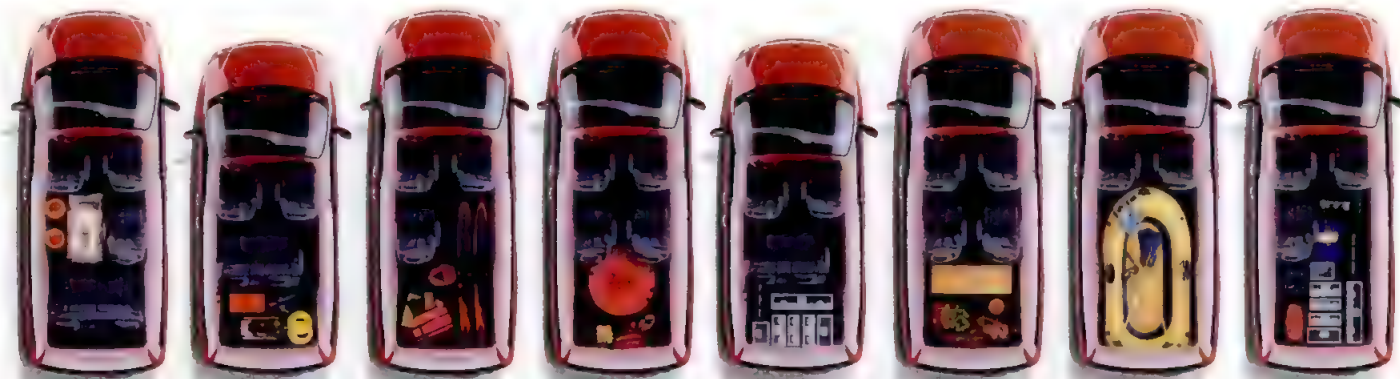
wheelbase Grand Caravan, is 37. Which we figure is just about right for your average



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exercise. The total number of possible configurations in all, including the longer



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BENCHMARK TESTS

playing the business applications found in our Winstone 98 test. The High-End Graphics WinMark stresses the graphics subsystem more heavily, drawing upon the computation and graphics-intensive applications in our High-End Winstone 98 test. Performance varies depending on the graphics chip set, graphics memory, RAMDAC, and driver, as well as the system's memory and bus architecture. We tested the mainstream PCs at 16-bit color depth and the high-end systems at 24-bit or 32-bit color depth. If the system is capable of both 24-bit and 32-bit true color modes, we tested at both settings.

In the mainstream category, the systems from Maximus, NEC, and Sys Technology,

all of which used Number Nine's Revolution 3D graphics card and its Ticket2Ride chip set, yielded the best Business Graphics WinMark 98 results. Systems from DirectWave and Micro X using the Matrox Millennium II card were also top scorers. The Acer AcerPower Network Ready with the ATI Video Xpression card and the Dell OptiPlex Gn+ with an on-board S3 Trio 64 V2 fared the worst.

We found that in general, systems using Windows NT perform slightly better under 24-bit true color than 32-bit true color. If you'll be using mostly 24-bit, our tests show that the Matrox Millennium II will likely be your card of choice; the top performers in this part of the roundup had them. In dis-

playing 32-bit color depth, however, the Number Nine Revolution 3D card was far superior—about 43 percent on average—to the Millennium II. (Although the 32-bit mode does not offer any visual enhancement, some 3-D applications may require this mode).

With a score that was 40 percent above the mean, Compaq's high-end corporate machine, which used the AGP version of the Millennium II card, earned the top slot in Business Graphics WinMark. Surprisingly, the system best equipped to handle high-end graphics under Windows NT was the Polywell Poly 7266S1 with its Matrox Millennium; this is an older card whose driver has matured and is perhaps better

▲ High scores are best.

▼ Low scores are best.

Black bold type denotes first place.

Red bold type denotes GDI bypassing.[†]

**2D Business
Winstone 98**
Score

**2D Business Graphics
WinMark 98**
24-bit score

**2D Business Disk
WinMark 98**
Thousands of bytes per second

MAINSTREAM

AcerPower Network Ready	14.0	58	1,110
Advanced Megatrends Apollo 233M5	17.7	108	1,140
Compaq Deskpro 4000 5233X/3200/CDS	16.9	87	1,010
Comtrade Corporate PC	16.8	92	1,220
Dell OptiPlex Gn+	15.6	62	1,160
Digital PC 5100 5233M	17.3	90	1,170
Digitron Micro Solution NS2000	16.6	102	1,240
DirectWave MVP VX-233	17.8	115	1,150
Everex Step Premier	16.1	76	900
Gateway E-3000-1233MMX	17.1	91	1,120
HP Kayak XA 5/233 PC Workstation	16.5	93	915
HiQ K6-200 MPC	17.0	100	1,130
IBM PC 300PL	16.5	96	1,260
Maximus Magna Media	16.6	113	1,120
Mega Impact PentiumMMX200+	15.8	73	1,130
Micron Client Pro MRE	17.6	101	1,130
Micro X MXP-5100	17.5	117	1,100
NEC Enterprise Series Managed PC	18.1	115	1,340
Nova K6200C	17.1	101	1,150
Polywell Poly 500TX1	17.5	92	1,200
ProGen Discover3D 233	16.5	107	1,110
Seenix TCOe 200	15.3	77	926
SMD Mount Hood MMX	17.6	102	1,160
Sys Performance 233M2	19.5	135	1,290
Toshiba Equium 5200D	15.5	70	1,190
Total Peripherals Serengeti-200MX	17.0	79	1,160
Zenon Dream Media Plus	16.0	82	1,140

(†) GDI bypassing inflates scores at the expense of compatibility with certain applications. (‡) With an Action, MPEG-1, 352-by-240, 30-fps, 300-Kbps clip

optimized for NT.

Only three of the high-end systems were equipped with AGP cards, but none could take full advantage of the AGP's advanced features such as texturing mode and side-band addressing because AGP lacks adequate driver support under Windows NT 4.0.

ZD Business Disk WinMark 98 and ZD High-End Disk WinMark 98 ZD Business Disk WinMark 98 and ZD High-End Disk WinMark 98 are measures of data transfer rates to and from the hard disk in thousands of bytes per second while running the applications profiled in ZD Business Winstone 98 and ZD High-End Winstone 98, respectively.

The systems with IBM's Deskstar 5 Ultra ATA drives, which can transfer data at speeds up to 33 MBps, garnered four of the top five disk scores in the mainstream category. Systems with the Western Digital Caviar AC33100 Fast ATA-2 disk, limited to a 16.7-MBps transfer rate, scored poorly.

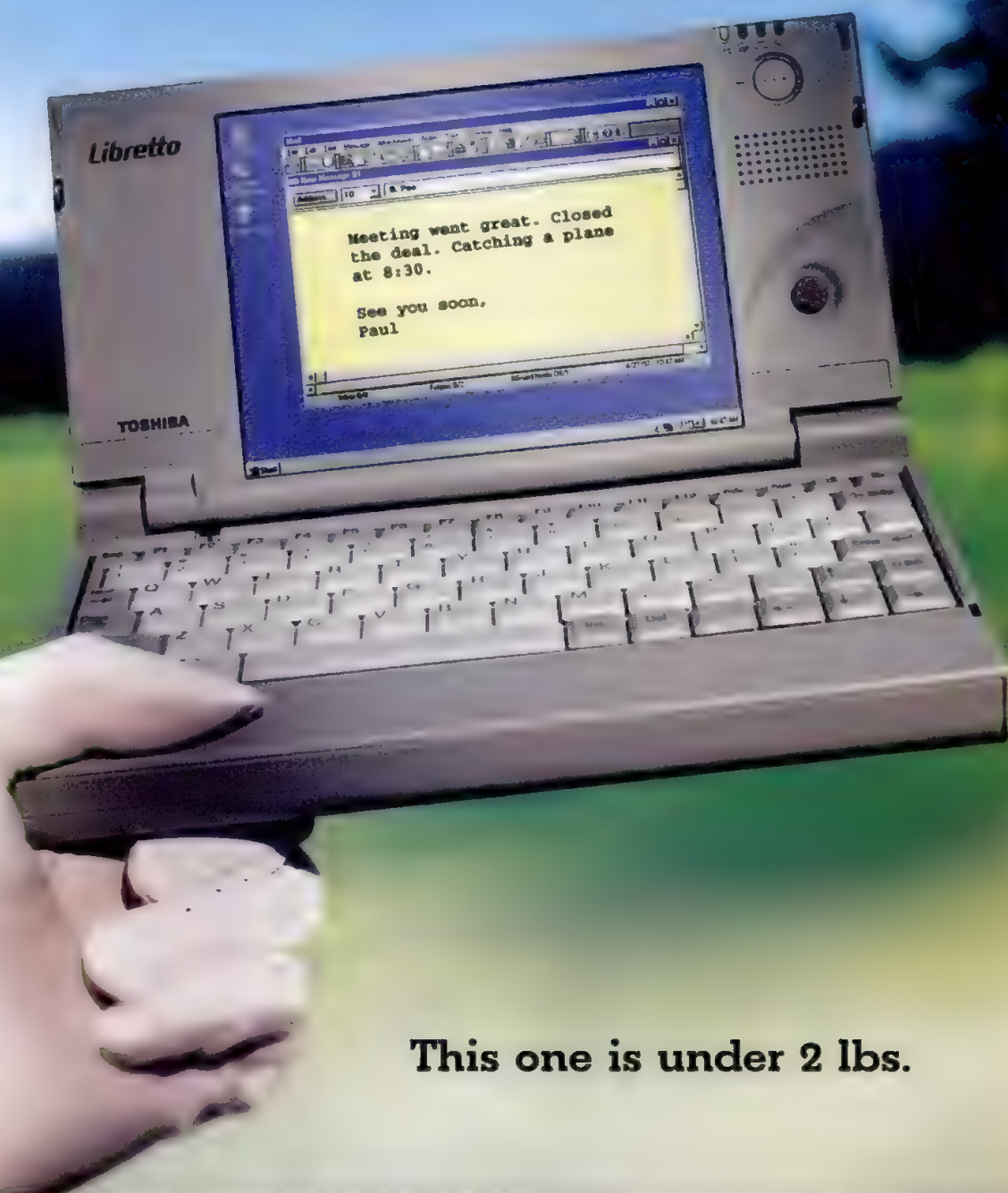
In running business and high-end applications under Windows NT 4.0, high-end PCs with the IBM Deskstar 5 were still among the best, but those using the Quantum Fireball ST Ultra ATA drive were close behind, followed by the Maxtor 85120A8 ATA-3 drive. Compaq's Deskpro 4000 6266X/3200/CDS, with a slow 4,480-rpm Maxtor 83201A6 Fast ATA-2 drive

(most other drives spin at 5,400 rpm), earned a High-End Disk WinMark score that was 36 percent lower than the norm.

ZD CD-ROM WinMark 98 With CD-ROM WinMark 98, we measure the CD-ROM drive's transfer rate and access time in running the best-selling CD titles to reflect the CD-ROM or DVD drive's performance in real-world applications where data is not always read sequentially. The Toshiba XM-6102B drive was the undisputed speed king in both categories. Its outstanding scores were the result of the drive's 24X maximum spindle speed and an access time of 90 ms. —Analysis written by S. Jae Yang

ZD CPUmark32 Score ▲	ZD CD-ROM WinMark 98 Score ▲	CD-ROM			Full-Screen Scaling ²	
		Access Time (milliseconds) ▼	CPU Utilization (percent) ▼	Transfer Rate: Inside (thousands of bytes per second) ▲	CPU Utilization (percent) ▼	Maximum Frame Rate (frames per second) ▲
380	1,400	100	43	1,880	80	40.1
471	1,260	101	22	2,010	93	33.1
461	1,110	125	57	1,600	66	48.7
461	1,550	94	57	2,180	97	29.8
413	1,320	114	52	2,040	64	50.2
466	1,330	105	9	2,010	61	54.0
449	1,020	140	47	1,810	97	29.8
476	1,320	98	37	2,160	93	33.0
467	1,080	120	46	1,830	97	28.7
465	1,160	124	22	1,830	53	56.8
458	815	180	6	1,230	97	27.4
525	1,240	105	22	2,010	97	28.3
431	1,340	93	9	1,790	97	28.8
430	1,310	99	43	2,110	98	25.7
422	1,340	94	44	1,800	97	29.7
466	1,440	83	46	1,870	64	53.4
471	1,250	108	75	1,800	96	29.9
468	1,070	120	9	1,830	98	25.3
513	1,170	125	20	1,820	97	29.0
474	1,310	99	23	2,060	74	43.1
437	1,260	103	25	2,010	95	32.4
425	1,330	96	55	2,120	82	48.7
532	1,390	101	49	2,040	97	24.4
498	899	163	11	1,430	97	23.6
390	1,140	127	43	1,840	66	48.1
463	1,290	96	21	1,840	93	33.2
430	1,050	125	19	1,440	59	54.5

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riser card, integrates three DIMM slots, audio, Digital's 10/100 Ethernet, and S3 Virge graphics. Performance was average.

Housed in a tool-free ATX mini-tower, the 5500 provides much more room for expansion than the 5100 and has a slot for a second CPU. A removable Digital motherboard integrates audio, Ethernet, and a Matrox Millennium graphics chip set. In our test system, the integrated graphics were disabled, and the graphics were handled instead by a Millennium II card (4MB WRAM).

Equipped with a Quantum Fireball Ultra ATA hard disk, the 5500 was the second-highest scorer in its class on our High-End Disk WinMark 98 test. The disk was unable to take advantage of the Ultra DMA protocol (the system uses a 440FX chip set), but neither could most others in this class. All other scores were average.

Digital has designed two eminently accessible PCs and should be commended for its proprietary DMI software. ClientWorks is an admirable package that requires merely a few key additions.—*CM Digital Equipment Corp.*, Maynard, MA; 800-344-4825, 508-624-6400; fax, 508-480-8583; www.windows.digital.com. Circle 494 on reader service card.

Digitron Micro Solution PG3000, NS2000

PG3000: Pentium II/266, 6GB hard disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 27.3. \$2,400 street.

NS2000: Pentium MMX/233, 6GB hard disk, 15-inch monitor, EDO DRAM. Business Winstone 98: 16.6. \$1,900 street.

Of Digitron Micro Solution's two attractively priced corporate offerings—the mainstream NS2000 and the high-end PG3000 midtowers—only the latter offers adequate asset management. Both systems are relatively easy to service, although neither case offers tool-free access.

The PG3000 comes with an Intel motherboard which carries an LM78 ASIC that monitors fan status, motherboard voltage, and temperature. LANDesk Client Manager 3.0 comes with both units; it was able to browse and monitor all key components. The system was set up with a Creative Labs Sound Blaster AWE64 sound board and a 3Com Ethernet 10/100 adapter. The unit also came with a Cirque

Input Center keyboard, which has a touch pad that can capture signatures.

The NS2000 was configured with a BCM Advanced Research motherboard that lacked a hardware monitor chip; hence features such as thermal warnings and fan-failure alerts were not available. LANDesk was able to browse only a few components on the NS2000, such as the sound board and hard disk. The unit includes the same network adapter as its sibling and has a Shark Multimedia sound board.

The NS2000 posted average scores on all of our benchmark tests except for its CD-ROM WinMark 98 score, which was below average. The PG3000 yielded average scores on all of our high-end tests and above-average scores on our business tests.

Both units came with motherboards that could slide out after the removal of a few screws. Digitron Micro Solution offers a one-year warranty. Technical support is available during business hours and on Saturdays.

These units offer competitive performance and are fairly serviceable, but only the PG3000 offers adequate management features.—*RSA*

Digitron Micro Solution Inc., City of Industry, CA; 888-708-2800, 626-913-6136; fax, 626-913-9768; www.digitronpc.com. Circle 453 on reader service card.

DirectWave MVP VX-233

Pentium MMX/233, 6GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98: 17.8. \$2,099 direct.

Offering terrific performance at a bargain price, DirectWave's MVP VX-233 is indeed an attractive mainstream corporate system. Its management features are adequate.

The system came with Intel's LAN-Desk 3.0 Client Manager, which was able to browse the details of the unit's hard disk, sound board, and memory size but did not yield information on the Intel EtherExpress Pro/100B Ethernet card, the 33.6-Kbps voice modem, or the graphics card. Working with the integrated LM78 ASIC, LANDesk was able to monitor thermal and fan malfunction alerts. LANDesk 3.1 will ship by press time.

The MVP VX-233 performed very well, earning above-average scores across our tests thanks to such hardware as a Matrox Millennium II graphics card and a



Digital PC 5500 6266, 5100 5233M

PC 5500 6266: Pentium II/266, 3GB disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 28.5. \$3,700 street.

PC 5100 5233M: Pentium MMX/233, 3GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 17.3. \$2,450 street.

In an effort to simplify its PC branding and leverage its familiar company name, Digital Equipment Corp. has rechristened its Venturis and Celebris corporate lines. The Venturis has become the Digital PC 3000, a line of value machines, whereas mainstream and high-end Celebris units now fall under the Digital PC 5000 mantle. Both of the 5000 series machines we tested—especially the 5100—offer strong management features and are easy to service, making them good corporate choices.

Both systems come with ClientWorks, Digital's proprietary management software. The 5500 uses Version 2.3d of ClientWorks, which provides full data on system characteristics through a classic DMI browser tree structure. The 5100 supports Version 2.9 of ClientWorks, which adds remote wake-up (known as SecureON), a chassis intrusion detector (SecureBOX), thermal sensors, voltage sensors, and SMART hard disk support. Automatic alarms in case of problems and fan monitoring, however, will not be added until the software's next revision, due at year's end.

The 5100 is a slimline desktop that uses the new NLX motherboard form factor. After removing the tool-free chassis, you can slide the entire motherboard out for servicing: Simply flip two levers and pull. The board, which plugs into a vertical



Applied DMI: solutions and pitfalls

When properly set, DMI-compliant systems give administrators a wealth of detailed information on major components and subsystems, I/O ports, and bus slots. Administrators can also be alerted to chassis intrusions, high temperatures and voltages, and malfunctions.

Most systems we tested implement DMI by using Intel's LANDesk Client Manager, but many leading vendors—such as Compaq, Dell, Digital, and Hewlett-Packard—use their own management applications.

LANDESK

With Intel LANDesk, system attributes and health can be monitored either locally or remotely through a browser or a user-friendly GUI. The remote version also lets you update system files.

Most of the tested systems used LANDesk 3.0; a few had Version 3.1, which should be more readily available by the time you read this. As specified by DMI 2.0, LANDesk 3.1 handles remote management via the standard Remote Procedure Calls (RPC) rather than with the proprietary calls used by 3.0. This allows LANDesk to be used with other DMI 2.0 management applications. All coding is now HTML-based, which has greatly simplified the creation of the component interface. With the proper hardware, 3.1 will allow you to shut down and wake up a machine remotely; its DMI browser now uses a Windows Explorer format.

Because Intel licenses LANDesk to PC manufacturers who then customize and preload it on their systems, the quality of implementations varies widely. To get the most from LANDesk, you need:

- A complete component interface (the low-level DMI software layer that talks directly to hardware). The level of detail available to you depends on how well vendors have implemented this. Unless you have an extensive component interface, LANDesk will not give a full inventory of components.

- A DM (Desktop Management) compliant BIOS. Such a BIOS provides key pieces of data to the component interface and service provider (the standard piece of DMI code that gathers data from the component interface and stores it in a MIF database).

- A hardware-monitoring chip, such as National Semiconductor's LM78 ASIC, which is designed specifically for LANDesk. The LM78 detects high temperatures and voltages and can potentially identify fan failures and chassis intrusions. Monitoring the former problem requires fans that plug into the motherboard rather than the main power supply; for the latter, you need an optical or, better, a physical switch linked to the chip for monitoring. Some PCs may use an add-on DMI card to handle hardware monitoring.

- Proper supporting hardware for features such as Wake-on-LAN, which requires a specialized Ethernet adapter.

LANDesk will always be able to glean some pieces of information. Data on GDI usage problems and low memory or disk space levels comes directly from Windows and is available to the management software as long as a DMI service layer is present. Self-monitoring SMART hard disks catch problems before they become critical and automatically report that information.

PROPRIETARY SOLUTIONS

All of the following solutions provide an inventory of system components, both locally and remotely. Some do much more.

Compaq's Insight Manager, used by the two Deskpro PCs we tested, is among the most complete management packages on the market. This solution duplicates each of LANDesk 3.1's major features—and allows administrators to lock the chassis remotely, as well

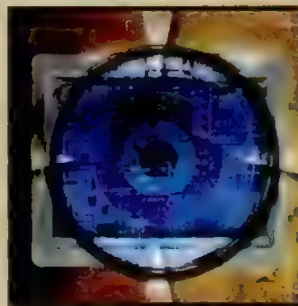
as to disable its floppy disk drive, keyboard, or CD-ROM, and update its BIOS. Insight Manager's only drawback is its interface, which isn't as user-friendly as it could be.

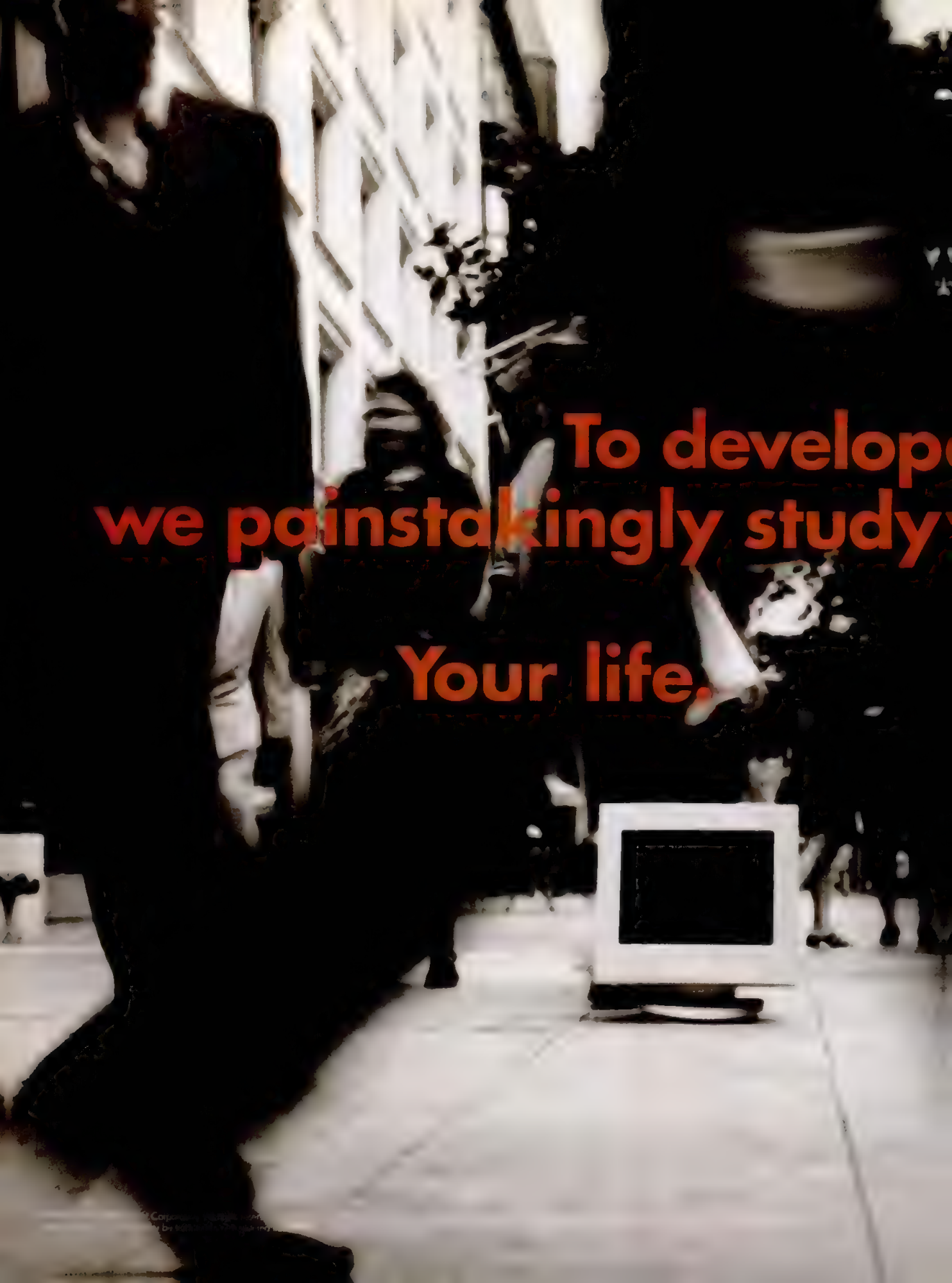
Dell Inspector 2.0, installed in the OptiPlex Gn+ and OptiPlex GXa, offers a detailed system inventory from an easy-to-use GUI but cannot detect chassis intrusions, fan failures, or high temperatures and voltages. When fully implemented, LANDesk is the better solution.

Digital's ClientWorks 2.9 offers the monitoring features that Dell Inspector lacks (except fan failure detection) but—inexplicably—does not launch an alarm window when it identifies a problem. You must actively search the ClientWorks database before you're aware of system errors. The package does support SMART technology and remote wake-up; its data is stored in a classic DMI tree structure, which can be inconvenient and unwieldy.

Though it wasn't fully implemented on the two Hewlett-Packard PCs reviewed here, HP's TopTools 2.1 (2.5 will be available by the time you read this) rivals Insight Manager. It can't lock a chassis, but it can disable various hardware components from afar; it also handles remote BIOS updates and has a slick, intuitive GUI. With the right hardware, TopTools can wake a system up and predict the failure of ECC memory modules or hard disks.

IBM does not have its own complete DMI package, but it augments its LANDesk implementation with a proprietary application, the LCCM (LanClient Control Manager). Like Insight Manager and TopTools, LCCM, in conjunction with IBM AssetCare, provides standard inventory and asset tracking features, plus remote wake-up, remote component locking, and remote BIOS updates.



A black and white photograph of a busy city street. In the foreground, a computer monitor sits on the sidewalk. The background is filled with the motion-blurred silhouettes of people walking, creating a sense of a fast-paced urban environment. The text is overlaid in a bold, orange-red font.

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monitors this advanced, a very complex system.

The P110, the first 21" (19.8" viewable) Trinitron monitor in existence, is designed for artistic souls whose ideas are simply too big for a smaller screen. The TFT500 flat panel is extraordinary in its ability to fit neatly into corners, like a corner office rampant with power piles and golf equipment. The P50 and V70 offer the performance and value you'd expect from the best-selling brand of monitors on earth. They also offer the best refresh rates in their class. A common trait for those of us who associate a mere 40-hour work week with part time employment.

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COMPAQ

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itor hardware, the connection from the unit's fans to the sensors was not installed. Network connectivity is provided by the Intel EtherExpress PRO/100B adapter.

IS managers will appreciate the accessibility of all of the internal components, making upgrades a snap. Everex also facilitates driver updates by keeping drivers on its Web site. Our test system had SIMMs, but the unit can handle DIMMs as well.

On-site service is free the first year; parts and labor are covered for three years. Though 24-hour replacement is not available, Everex guarantees 48-hour turn-around. Technical support is available 24 hours, seven days. The Step Premier comes at an attractive price and provides adequate management.—FJE

Everex Systems Inc., Fremont, CA; 800-383-7391, 510-498-1111; fax, 510-683-2186; www.everex.com. Circle 458 on reader service card.

Gateway E-3100-1266, E-3000-1233MMX

E-3100-1266: Pentium II/266, 7.9GB hard disk, 19-inch monitor, SDRAM. High-End Winstone 98: 30.5 \$3,041 direct.

E-3000-1233MMX: Pentium MMX/233, 3GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 17.1. \$2,013 direct.

Having firmly established its built-to-order business in the consumer market, Gateway is making a significant push in the corporate space with its E-series. Leading the way is this pair of well-managed PCs, the high-end E-3100-1266 and mainstream E-3000-1233MMX, two of only five machines in our roundup with Version 3.1 of Intel's LANdesk Client Manager installed. Both systems ship with LM78 ASICs, chassis intrusion alarms, and copies of Microsoft Office 97 Small Business Edition.

In addition to its LANdesk 3.1 implementation, the E-3100 offers plenty of room for expansion. Its familiar Gateway midtower case is relatively easy to open: Simply remove two thumbscrews. The unit's interior is not as neat as it could be (cables partially obstruct the motherboard's three DIMM slots), but it offers an admirable set of hardware components, including Intel's LX chip set, an Accel-graphics AGP card (3DLabs chip set, 8MB SGRAM), a Sound Blaster audio card, and a 10/100 Ethernet card. Of course, because

the unit is running Windows NT 4.0, its graphics solution does not use AGP's dedicated path to main memory.

Equipped with IBM's 8GB Ultra ATA hard disk, the E-3100 won above-average scores on our Business Disk WinMark 98 and High-End Winstone 98 tests. Its Business Disk WinMark score was, in fact, the highest in its class. Gateway's choice of CD-ROM, a 12X Toshiba, performed well below the mean, but all of the other scores were average for the unit's class.

The E-3000, a desktop design, is more modest than the E-3100. Though it, too, has an Ultra ATA drive, its test scores were average in every case. Other core components (Intel's TX chip set, integrated ATI 3D Rage II graphics with 2MB SGRAM) are respectable. The system—as shipped to us—lacks an audio card. Like its sibling, the E-3000 has a tool-free chassis.

Gateway offers a three-year parts, one-year labor warranty and around-the-clock technical support. This pair of managed PCs are certainly viable options for the networked corporate buyer.—CM

Gateway 2000 Inc., N. Sioux City, SD; 800-846-200, 605-232-2000; fax, 605-232-2023; www.gateway.com. Circle 460 on reader service card.

HP Kayak XA 6/266 PC Workstation, XA 5/233 PC Workstation

XA 6/266 PC Workstation: Pentium II/266, 4GB hard disk, 15-inch monitor, SDRAM. High-End Winstone 98: 26.2. \$3,500 street.

XA 5/233 PC Workstation: Pentium MMX/233, 2.4GB hard disk, 15-inch monitor, EDO DRAM. Business Winstone 98: 16.5. \$2,460 street.

Few companies are better than Hewlett-Packard at designing systems that combine ease of service, informational tools, and solid hardware. The XA 6/266 PC Workstation, the high-end of the XA line, and the entry-level XA 5/233 PC Workstation continue in that tradition.

HP TopTools, the company's proprietary DMI software, sets these systems apart. We saw Version 2.0 with the mainstream unit and 2.1 with the 6/266; Version 2.5 will ship by the time you read this. It can notify administrators of ECC memory errors and possible POST or hard disk errors, and it provides detailed information about components. It also allows



Gateway 2000 E-3100-1266

24X CD-ROM drive. Corel WordPerfect Office Suite 8 is also bundled with the unit.

The system came in a standard screw-open midtower case, but this will soon be replaced by a tool-free, lockable case, according to the company. The ATX-style ASUS motherboard uses Intel's 430TX PCI chip set and slides out easily after the removal of several screws.

DirectWave offers a three-year warranty with one year of on-site service and toll-free 24-hour technical support. The company's Web site provides basic troubleshooting information as well as links to Web sites of peripherals manufacturers. You'll get good performance at a great price as well as some basic management features with this unit.—RSA

DirectWave Inc., Orange, CA; 800-882-8108, 714-978-9283; fax, 714-978-7363 www.directwave.com. Circle 454 on reader service card.

Everex Step Premier

Pentium MMX/233, 2.9GB hard disk, 15-inch monitor, EDO DRAM, Business Winstone: 16.1. \$1,990 street.

Everex's Step Premier is a well-built, no-frills mainstream system offering a good blend of performance, ease of servicing, and low cost. Using Intel's latest Pentium MMX chip set, the 430TX, the system earned average scores across all of our benchmark tests.

Everex provided Intel's LANdesk 3.0 with our tested system; LANdesk 3.1 will be included in the last quarter of 1997. The software was able to identify most components, including the sound card. Although the unit has an LM78 ASIC that can mon-



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SUMMARY OF FEATURES

Corporate Managed PCs



Price of tested configuration For PCs sold through resellers, assume that street prices will be 15 to 20 percent lower than list prices. Some vendors factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price. All street prices are rounded to the nearest \$10. Some vendors sell directly to customers. In those cases, we list the prices as *direct*; such prices are not discounted. Prices include the monitors.

Installed RAM type Synchronous DRAM (SDRAM) offers a performance advantage over extended data out (EDO) DRAM, because the access to SDRAM is synchronized to the CPU's clock in order to minimize wasted clock cycles.

Hard disk interface Fast ATA supports PIO mode 3 and multiword DMA mode 1 and has a maximum burst transfer rate of 13.3 MBps. Fast ATA-2 drives support up to PIO mode 4 and multiword DMA mode 2 and have a maximum burst transfer rate of 16.7 MBps. Hard disks with an ATA-3 interface have more enhanced features than ATA-2 drives, with support for Plug and Play, for example. Throughput is the same as for ATA-2 drives. Ultra ATA drives comply with the Ultra DMA specification, which supports a burst throughput of up to 33.3 MBps.

Graphics adapter interface Accelerated Graphics Port (AGP) is a high-speed point-to-point connection between the system chip set and the graphics chip. Graphics cards that use AGP can access system memory directly through the system chip set at memory-bus speeds, which are faster than standard PCI connections. AGP also provides a cost-effective way for graphics subsystems to access large amounts of memory for fast 3-D rendering. Most graphics subsystems still go through the PCI bus, either through an adapter card or through integrated chip sets.

Remote management implemented This means the system has a network adapter and the Administrator Console portion of LANDesk or the equivalent software in proprietary solutions installed; this allows for remote reboot and wake-up as well as remote file updating. In cases where this has not been implemented, you may have to contact the vendor and request this software component.

■ YES ■ NO

Products listed in alphabetical order

	AcerPower Network Ready	Advanced Megatrends Apollo 266PII-D	Advanced Megatrends Apollo 233M5	Compaq DeskPro 4000 6266X/ 3200/CDS
Category	Mainstream	High-end	Mainstream	High-end
Price of tested configuration	\$1,100 street	\$2,899 direct	\$2,499 direct	\$2,950 street
Processor	Pentium MMX/166	Pentium II/266	Pentium MMX/233	Pentium II/266
Installed RAM type	EDO DRAM	EDO DRAM	SDRAM	SDRAM
Hard disk	Quantum Fireball ST	Quantum Fireball ST	Quantum Fireball ST	Maxtor 83201A6
Capacity and interface	3.1GB Ultra ATA	6GB Ultra ATA	6GB Ultra ATA	3GB ATA-3
Graphics adapter (interface)	ATI Video Xpression (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (AGP)
Memory	2MB DRAM	4MB WRAM	4MB WRAM	8MB WRAM
Graphics chip set	ATI 264VT2	Matrox MGA-2164WP-C	Matrox MGA-2164WP-C	Matrox MGA-2164WA-B
Monitor (measured diagonal size, in inches)	AcerView 78ie (13.7)	ViewSonic 15GS (14)	ViewSonic 15GS (14)	Compaq V50 (13.8)
Installed external RAM cache and type	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard	Acer V35LA-N	SuperMicro P6DKF	SuperMicro P5MMA98	Compaq
Chip set	Intel 430HX	Intel 440FX	Intel 430TX	Intel 440LX
BIOS manufacturer and version (or date)	Acer R01 E0	AMI v2.2	AMI v1.38	Compaq (7/14/97)
CD-ROM drive speed and model	12X-24X Acer 920E	12X-24X Matsushita CR-585-B	12X-24X TEAC CD-524E	10X-24X Compaq CR-5850-BCQ

Networking, Communications, and Management Features

Network adapter	3Com 10/100	Intel EtherExpress Pro/100B	Intel EtherExpress Pro/100B	Compaq Netelligent 10/100 TX
Desktop management software	Intel LANDesk 3.1	Intel LANDesk 3.0	Intel LANDesk 3.0	Compaq Insight Manager
Remote management implemented	■	■	■	■

Expandability

Maximum RAM	128MB	1GB	256MB	384MB
Expansion-bus slots	1 ISA, 2 PCI/ISA	3 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 2 PCI, 1 PCI/ISA
Front-accessible drive bays (5.25" / 3.5")	1 / 1	6 / 1	3 / 2	2 / 1
Internal drive bays (5.25" / 3.5")	1 / 1	0 / 2	0 / 2	0 / 2
Power-supply wattage	100	300	235	240
Parallel/serial ports	1 / 2	2 / 2	1 / 2	1 / 2
Mouse/USB ports	1 / 2	1 / 2	1 / 2	1 / 2

Service and Support

24-hour, 7-day live technical support	■	■	■	■
Standard warranty on parts/labor	3 years/3 years	3 years/1 year	3 years/1 year	3 years/1 year
On-site service charge for 1 year	Included	Included	Included	Included
24-hour turnaround for parts replacement	■	■	■	■

administrators to turn on the system, upgrade the BIOS, and lock various components remotely. Although the units we received did not have functional monitoring of fan status, temperature, and chassis intrusion, HP plans to add these to its line; these features will be available on the high-end unit by the time you read this.

Both systems provide some thoughtful design touches: jacks for headphones in the front of the unit, a sliding toggle switch for volume control, and a special

"coffee break" switch that locks the keyboard and mouse on the system. On both, HP ships a programmable keyboard that can provide one-button access to certain applications. The units also have lights on the front of the case to indicate an active LAN connection via the included HP Enhanced 10/100 Ethernet adapter.

The XA 5/233 comes in a slimline desktop unit whose motherboard slides right out of the side of the tool-free case, making cards easily accessible. The hard

disk and 8X CD-ROM are screwed in and harder to service, which may seem superfluous on a system that can be locked. Except for below-average CD-ROM and disk scores, performance was average.

The XA 6/266's HP motherboard features Intel's 440LX chip set, integrated Cirrus Logic AGP graphics, and support for ECC memory. The case is tool-free but can also be locked. Most of the system's scores were average, except for an above-average Business Graphics Win-

Compaq DeskPro 4000 5233X/3200/CDS	Comtrade Corporate PC	Dell OptiPlex GXe	Dell OptiPlex Gx+	Digital PC 5500 6266	Digital PC 5100 5233M	Digitron Micro Solution PG3000	Digitron Micro Solution NS2000	DirectWave MYP VX-233
Mainstream	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end	Mainstream	Mainstream
\$2,220 street	\$2,125 direct	\$3,240 direct	\$2,307 direct	\$3,700 street	\$2,450 street	\$2,400 street	\$1,900 street	\$2,080 direct
Pentium MMX/233	Pentium MMX/233	Pentium II/266	Pentium MMX/233	Pentium II/266	Pentium MMX/233	Pentium II/266	Pentium MMX/233	Pentium MMX/233
SDRAM	SDRAM	SDRAM	EDO DRAM	EDO DRAM	SDRAM	EDO DRAM	EDO DRAM	SDRAM
Western Digital AC3200A	IBM DHEA-36480	Quantum Fireball ST	Quantum Fireball ST	Quantum Fireball ST	Quantum Fireball ST	IBM DHEA-36480	IBM DHEA-36480	Seagate ST36450A
3GB EIDE	6.4GB Ultra ATA	3.2GB Ultra ATA	3.2GB Ultra ATA	3GB Ultra ATA	3GB Ultra ATA	6GB Ultra ATA	6GB Ultra ATA	6GB ATA-3
Integrated (PCI)	Diamond Viper V330 (PCI)	Integrated (AGP)	Integrated (PCI)	Matrox Millennium II (PCI)	Integrated (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)
4MB SGRAM	4MB VRAM	4MB SGRAM	2MB VRAM	4MB WRAM	4MB SGRAM	4MB WRAM	4MB WRAM	4MB WRAM
S3 VIRGE GX	nVidia Riva 128	ATI 3D Rage Pro AGP	S3 Trio 64V2	Matrox MGA-2164WP-C	S3 VIRGE/GX	Matrox MGA-2164WP-C	Matrox MGA-2164WP-C	Matrox MGA-2164WP-C
Compaq V50 (13.8)	MAG Innovation DX15T (14.1)	Sony DH800HS (16)	Sony 800 HS (13.7)	Digital P-0CKV-FZ (16.1)	Digital PCX8V-FZ (16.1)	MAG DX15T (13.8)	MAG DX15T (14)	MAG DJ700 (16.2)
512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	256K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Compaq	ASUSTek TX97-X	Dell	Dell	Digital	Digital	Intel PD440 FX	BCM Advanced Research SQ576	ASUSTek TX97-X
VIA Apollo VP-2	Intel 430TX	Intel 440LX	Intel 430TX	Intel 440FX	Intel 430TX	Intel 440FX	Intel 430TX	Intel 430TX
Compaq (2/8/97)	Award (6/24/97)	Dell Bios v X14	Dell vX09	Phoenix (3/28/97)	Phoenix v4.0	AMI v1.00.04D7D0	Award (4/15/97)	Award v4.51PG
8X-16X Sony CDU-571	12X-24X Toshiba XM-6102B	12X-24X NEC CDR-1800	12X-24X NEC CDR-1800	12X-24X TEAC CD-524E	12X-24X TEAC CD-524E	7X-12X Toshiba XM-5702B	12X Toshiba XM-5701	12X-24X Toshiba XM-6102B
Compaq Netelligent 10/100 TX	Intel EtherExpress Pro/100 TX	3Com Fast EtherLink XL	3Com Fast EtherLink XL	Integrated (Digital PCI DEC 21143 DE 10/100)	Integrated (Digital PCI DEC 21143 DE 10/100)	3Com 3C905-TX	3Com 3C905-TX	Intel EtherExpress Pro/100B
Compaq Insight Manager	Intel LANdesk 3.0	Dell Inspector	Dell Inspector	Digital ClientWorks	Digital ClientWorks	Intel LANdesk 3.0	Intel LANdesk 3.0	Intel LANdesk 3.0
■	■	■	■	■	■	■	■	■
384MB	256MB	384MB	256MB	256MB	256MB	128MB	128MB	256MB
2 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 2 PCI/ISA	1 ISA, 1 PCI, 1 PCI/ISA	1 ISA, 3 PCI/ISA	2 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA
2/1	3/2	3/1	3/1	3/1	2/1	3/3	3/3	3/3
0/0	0/1	0/2	0/2	0/2	0/1	0/0	0/1	0/1
240	235	230	145	235	100	250	230	250
2/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
■	■	■	■	■	■	■	■	■
3 years/1 year	3 years/1 year	3 years/1 year	3 years/1 year	3 years/1 year	3 years/1 year	1 year/1 year	1 year/1 year	3 years/3 years
Included	\$25	Included	Included	Included	Included	\$200 (4 years)	\$200 (4 years)	Included
■	■	■	■	■	■	■	■	■

Mark 98 score and a below-average High-End Disk WinMark 98 score.

Compared with other systems, HP's units may seem costly. But they are well-designed, featuring superior DMI tools to help you manage your hardware assets and minimize downtime. That's what makes these systems compelling.—*FJE Hewlett-Packard Co., Palo Alto, CA; 800-322-4772, 415-857-1501; fax, 800-231-9300; www.hp.com. Circle 495 on reader service card.*

HIQ K6-233 HPC, K6-200 MPC

K6-233 HPC: K6-233, 6GB hard disk, 17-inch monitor, SDRAM. High-End Winstone 98: 21.4. \$2,600 street.

K6-200 MPC: K6-200, 3GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98: 17.0. \$1,900 street.

Price makes HiQ Computer's K6-233 HPC and K6-200 MPC (especially the K6-200) compelling, and they come with some good management features.

Housed in identical, easy-to-service cases, these systems have a lot in common. Their lockable Ultra ATA hard disks are in trays, enabling the drives to be pulled out for servicing, security, or travel. Both HiQ systems include Intel EtherExpress Pro/100B network cards, Intel's LANdesk Manager 3.0 software, and sensors that monitor the operational status of the fans, motherboard voltage, and the chassis temperature. Both PCs were equipped with sleep buttons, but

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SUMMARY OF FEATURES

Corporate Managed PCs

■ YES ■ NO	Everex Step Premier	Gateway E-3100-1266	Gateway E-3000-1233 MMX	HP Kayak XA 6/266 PC Workstation	HP Kayak XA 5/233 PC Workstation	HiQ K6-233 HPC	HiQ K6-200 MPC	IBM PC 300XL
Products listed in alphabetical order								
Category	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end
Price of tested configuration	\$1,990 street	\$3,041 direct	\$2,013 direct	\$3,500 street	\$2,460 street	\$2,600 street	\$1,900 street	\$3,650 street
Processor	Pentium MMX/233	Pentium II/266	Pentium MMX/233	Pentium II/266	Pentium MMX/233	AMD K6/233	AMD K6/200	Pentium II/266
Installed RAM type	EDO DRAM	SDRAM	SDRAM	SDRAM	EDO DRAM	SDRAM	SDRAM	EDO DRAM
Hard disk	Western Digital Caviar 33100	IBM DHEA-38451	Quantum Fireball ST	Quantum Fireball ST	Quantum Fireball TM	Quantum Fireball ST	Quantum Fireball ST	IBM DCAA-34330
Capacity and interface	2.9GB Fast ATA-2	7.9GB Ultra ATA	3GB Ultra ATA	4GB Ultra ATA	2.4GB Fast ATA-2	6GB Ultra ATA	3GB Ultra ATA	3.9GB Ultra ATA
Graphics adapter (interface)	Matrox Mystique (PCI)	Accel StarII 3D (AGP)	Integrated (PCI)	Integrated (PCI)	Matrox Millennium (PCI)	Matrox Millennium II (PCI)	Matrox Mystique (PCI)	Matrox Millennium II (PCI)
Memory	4MB SGRAM	8MB SGRAM	2MB SGRAM	4MB RDRAM	2MB WRAM	4MB WRAM	4MB SGRAM	8MB WRAM
Graphics chip set	Matrox MGA-1064SG-G	3DLabs Permedia2	ATI 3D Rage II DVD	Cirrus Logic CL-GD5465	Matrox MGA-2064W-R3	Matrox MGA-2164WP-C	Matrox MGA-1064SG-G	Matrox MGA-2164WP-C
Monitor (measured diagonal size, in inches)	Everex 15A (13.8)	Gateway EV900 (17.8)	Gateway EV-500 (14)	HP ERGO 1024 (14)	HP ERGO 1024 (14)	Panasonic S70 (16)	Panasonic S70 (16)	IBM P50 (13.6)
Installed external RAM cache and type	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard	Giga-Byte PT-2011	Intel AL440LX	Gateway	HP	HP	ASUSTek TX97-XE	ASUSTek TX97-XE	IBM PC 300XL
Chip set	Intel 430TX	Intel 440LX	Intel 430TX	Intel 440LX	Intel 430HX	Intel 430TX	Intel 430TX	Intel 440FX
BIOS manufacturer and version (or date)	AMI v1.12	Phoenix v4.0	Phoenix v4.0	Phoenix v4.0	Phoenix Rev. HA.07.06	Award v5X0107	Award v5X0107	IBM (7/24/97)
CD-ROM drive speed and model	12X-16X NEC CDR-1600A	7X-12X Toshiba XM-5702B	7X-12X Toshiba XM-5702B	12X-24X Matsushita CR-585-B	8X Panasonic CR-583	12X-24X TEAC CD-524E	12X-24X TEAC CD-524E	8X-16X Sony CDU-511F
Networking, Communications, and Management Features								
Network adapter	Intel EtherExpress Pro/100B	3Com 3C905 10/100	3Com 3C905 TX 10/100	HP Enhanced 10/100 Ethernet Interface	HP 10/100 TX	Intel 8465 B	Intel 8465B	Intel 82557 10/100
Desktop management software	Intel LANDesk 3.0	Intel LANDesk 3.1	Intel LANDesk 3.1	HP TopTools 2.1	HP TopTools 2.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0, NetFinity
Remote management implemented	■	■	■	■	■	■	■	■
Expandability								
Maximum RAM	512MB	384MB	256MB	384MB	192MB	128MB	128MB	384MB
Expansion-bus slots	3 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI	2 ISA, 2 PCI, 2 PCI/ISA	1 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI/ISA
Front-accessible drive bays (5.25" / 3.5")	3 / 2	3 / 2	2 / 1	3 / 1	1 / 2	2 / 3	2 / 3	2 / 1
Internal drive bays (5.25" / 3.5")	0 / 3	3 / 2	0 / 2	0 / 2	0 / 1	0 / 2	0 / 2	1 / 2
Power-supply wattage	235	200	200	150	100	250	250	200
Parallel/serial ports	1 / 2	1 / 2	1 / 1	1 / 1	1 / 2	1 / 2	1 / 2	1 / 2
Mouse/USB ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Service and Support								
24-hour, 7-day live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/3 years	3 years/3 years	3 years/3 years	3 years/3 years	3 years/3 years	3 years/1 year	3 years/1 year	3 years/1 year
On-site service charge for 1 year	Included	Included	Included	Included	Included	\$149	\$149	Included
24-hour turnaround for parts replacement	■	■	■	■	■	■	■	■
N/A—Not applicable. The product does not have this feature.								

they did not work on either system.

The MPC was a competitive performer for its class, with average scores on most of our tests save an above-average CPUmark₃₂ result. Using a K6 CPU in a field of systems with Pentium II processors, the HPC did not fare as well. Its CPUmark₃₂ score was below average, and despite its Matrox Millennium II graphics card, it had below-average results on both the Business and High-End Graphics WinMark 98 tests and the High-End Win-

stone 98. Other scores were average.

HiQ provides a three-year parts, one-year labor warranty. Three years of on-site service cost \$125. Technical support is available during business hours on weekdays and from 11:00 to 4:00 Pacific time on Saturdays.

Fairly good management features and an easy-access case mark these units.—FJE
HiQ Computer, Sunnyvale, CA; 800-827-5836, 408-245-5836; fax, 408-245-3108; www.hiq.com. Circle 462 on reader service card.

IBM PC 300XL, 300PL



PC 300XL: Pentium II/266, 3.9GB hard disk, 15-inch monitor, EDO DRAM, Business Winstone: 26.3, High-End Winstone 98: 27.9, \$3,650 street.

PC 300PL: Pentium MMX/233, 3.9GB hard disk, 15-inch monitor, EDO DRAM, Business Winstone: 16.5, \$2,650 street.

IBM, per usual, boasts some of the finest

PC MAGAZINE
EDITORS' CHOICE

IBM PC 300PL	Maximus Magna Media	Mega Impact Pentium II/266/64+	Mega Impact Pentium MMX200+	Micron Client Pro XLU	Micron Client Pro MRE	Micro X MXP-5100	NEC PowerMate Professional	NEC Enterprise Series Managed PC	Nova PI-200XC
Mainstream	Mainstream	High-end	Mainstream	High-end	Mainstream	Mainstream	High-end	Mainstream	High-end
\$2,650 street	\$3,880 direct	\$2,590 street	\$1,730 street	\$2,993 direct	\$1,949 direct	\$2,499 direct	\$2,890 street	\$2,000 street	\$2,499 direct
Pentium MMX/200	Pentium MMX/200	Pentium II/266	Pentium MMX/200	Pentium II/266	Pentium MMX/233	Pentium MMX/233	Pentium II/266	Pentium MMX/233	Pentium II/266
EDO DRAM	SDRAM	EDO DRAM	SDRAM	EDO DRAM	SDRAM	SDRAM	EDO DRAM	SDRAM	EDO DRAM
IBM DCAA-34330	Quantum Fireball ST	Maxtor 85120A8	Quantum Fireball ST	Quantum Fireball ST	Quantum Fireball ST	Western Digital AC 34300	IBM DHEA-36480	IBM DHEA-36480	Maxtor 85120A8
3.9GB Ultra ATA	6GB Ultra ATA	4.8GB ATA-3	4GB Ultra ATA	4GB Ultra ATA	3GB Ultra ATA	4.1GB Ultra ATA	6.2GB Ultra ATA	6.2GB Ultra ATA	4.8GB ATA-3
Matrox Mystique (PCI)	Number Nine Revolution 3D (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)	Diamond Stealth 3D 2000 PRO (PCI)	Diamond Stealth 3D 2000 PRO (PCI)	Matrox Millennium II (PCI)	Number Nine Revolution 3D (PCI)	Number Nine Revolution 3D (PCI)	Matrox Millennium II (PCI)
4MB SGRAM	8MB VRAM	4MB VRAM	4MB VRAM	4MB DRAM	4MB DRAM	8MB VRAM	8MB VRAM	4MB VRAM	4MB VRAM
Matrox MGA-1064SG-H	Number Nine Ticket2Ride	Matrox MGA-2164WP-C	Matrox MGA-2164WP-C	S3 VIRGE/DX	S3 VIRGE/DX	Matrox MGA-2164WP-C	Number Nine Ticket2Ride	Number Nine Ticket2Ride	Matrox MGA-2164WP-C
IBM P50 (13.6)	Viewsonic VP140 (14.2)	MGC DA-1585 (13.9)	MGC DA-1585 (13.9)	Micron RMD5L11 (13.8)	Micron 500FBX (14.3)	Princeton E075 (16)	NEC Multisync XV17+ (16.0)	NEC Multisync XV15+ (13.9)	Hansol E15-AL (13.6)
512K pipelined-burst	512K pipelined-burst	512K asynchronous	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
IBM PC 300PL	Super Micro P5MMA98	BCM Advanced Research KR660	BCM Advanced Research FR550	Intel 82440FX	Intel LT430TX	SuperMicro P5MMA98	Intel Portland	Intel CN430TX	Intel PD440FX
Intel 430HX	Intel 430TX	Intel 440FX	Intel 430TX	Intel 440FX	Intel 430TX	Intel 430TX	Intel 440FX	Intel 430TX	Intel 440FX
IBM (7/25/97)	AMI D604866	Award (4/2/97)	Award (4/2/97)	AMI 4L3TT0XB-05A.0002.A	Phoenix 4L3TT0XB-05A.0002.A	AMI v1.2	Phoenix 3.03.01	Phoenix (7/16/97)	Award 4.51PG
12X-24X Matsushita CR-585	12X-24X Toshiba XM-6102B	12X-24X Toshiba XM-6102B	12X-24X Matsushita CR-585-B	12X-24X Hitachi CDR-8330	12X-24X Hitachi CDR-8330	12X-24X Lite-On LTN-242	12X-16X NEC CDR-1600A	12X-16X NEC CDR-1600A	7X-12X Toshiba XM-5702B
Intel 82557 10/100	Intel EtherExpress Pro/100B	3Com 3C905-TX	3Com 3C905-TX	Intel EtherExpress Pro 10/100	Intel EtherExpress Pro/100	3Com Fast EtherLink XL 3C905	3Com 3C590 TPO	Intel EtherExpress Pro/100	3Com Fast EtherLink XL
Intel LANDesk 3.0, NetFinity	Intel LANDesk 3.0	Norton Administrator 1.0	Norton Administrator 1.0	Intel LANDesk 3.1	Intel LANDesk 3.1	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0
384MB	256MB	256MB	128MB	256MB	256MB	256MB	256MB	256MB	256MB
1 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 1 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
2/1	3/2	3/2	2/2	2/3	2/3	3/2	3/1	1/1	3/2
0/1	0/1	0/2	0/1	0/2	1/2	0/1	2/1	1/1	0/1
150	235	235	235	235	235	230	200	200	250
1/2	1/2	1/2	1/2	1/1	1/1	1/2	1/2	1/2	1/2
1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
3 years/1 year	1 year/1 year	2 years/2 years	2 years/2 years	CPU and memory, 5 years; other, 3 years/3 years	CPU and memory, 5 years; other, 3 years/3 years	5 years/3 years	3 years/3 years	3 years/3 years	3 years/3 years
Included	Included	N/A	N/A	Included	Included	Included	Included	Included	\$50
				N/A	N/A				N/A

corporate PC technology on the market. The mainstream 300PL, one of our Editors' Choice winners, and the high-end 300XL ship with excellent LANDesk 3.0 implementations—as well as IBM's LAN-Client Control Manager (LCCM), which allows remote BIOS updates, and NetFinity, IBM's LAN management package.

Both the PL and the XL ship with customized LANDesk installation disks that take most of the difficulty out of configuring these systems as DMI clients. Once

installed, in each case LANDesk monitors board temperatures, voltages, fan operation, and chassis intrusion while providing a healthy amount of system inventory data.

With LCCM, IBM joins Hewlett-Packard and Compaq as the only vendors in this roundup to provide remote BIOS updates. The units have Wake-on-LAN technology, which IBM pioneered, remote power-on, the capability to lock various components remotely, and an Enhanced Asset Information Area, a piece of dynam-

ically readable memory that stores the serial numbers of core components—valuable information in case of theft.

Though the two units look similar from the outside—both have a tool-free chassis whose sliding front door covers the external drives—they use different motherboard designs. The PL is an NLX model whose motherboard easily slides out for servicing (after you've removed three screws and the metal side panel), whereas the XL uses a less-accessible LPX form



Some truths about Windows NT® that HP, Compaq and IBM don't want you to know: We have more Windows NT-certified engineers than they do. Here are just 8 of our over 1600 high priests of NT.

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SUMMARY OF FEATURES

Corporate Managed PCs

■ YES ■ NO

Products listed in alphabetical order

	Nova K6-200C	Polywell Poly 7266S1	Polywell Poly 500TX1	ProGen Polaris 266NT	ProGen Discover3D 233	Seenix TC0e 200	SMD Mount Hood MMX	Sys Performance Pro 266A
Category	Mainstream	High-end	Mainstream	High-end	Mainstream	Mainstream	Mainstream	High-end
Price of tested configuration	\$1,799 direct	\$2,759 direct	\$1,998 direct	\$2,499 direct	\$1,699 direct	\$1,594 direct	\$1,650 direct	\$2,349 direct
Processor	AMD K6/200	Pentium II/266	Pentium MMX/233	Pentium II/266	Pentium MMX/233	Pentium MMX/200	AMD K6/200	Pentium II/266
Installed RAM type	SDRAM	EDO DRAM	SDRAM	EDO DRAM	EDO DRAM	SDRAM	SDRAM	EDO DRAM
Hard disk	Maxtor 85120A8	Maxtor 85120A8	Maxtor 85120A8	Maxtor 85120A8	Quantum Fireball ST	Western Digital Caviar 33100	Quantum Fireball ST	IBM DHEA-36480
Capacity and interface	4.9GB ATA-3	4.9GB ATA-3	4.9GB ATA-3	4.9GB ATA-3	4GB Ultra ATA	2.9GB Fast ATA-2	3GB Ultra ATA	6.1GB Ultra ATA
Graphics adapter (interface)	Matrox Millennium II (PCI)	Matrox Millennium (PCI)	Diamond Stealth 3D 2000 (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)	MpeVGA Pro 3D (PCI)	Matrox Mystique (PCI)	Number Nine Revolution 3D (PCI)
Memory	4MB WRAM	8MB WRAM	4MB DRAM	4MB WRAM	4MB WRAM	4MB EDO DRAM	4MB SGRAM	8MB WRAM
Graphics chip set	Matrox MGA-2164WP-C	Matrox MGA-2064W-R2	S3 ViRGE	Matrox MGA-2164WP-C	Matrox MGA-2164WP-C	S3 ViRGE/DX	Matrox MGA-1064SG-D	Number Nine Ticket2Ride
Monitor (measured diagonal size, in inches)	Hansol E15-AL (13.9)	Sampo KM-711 (15.9)	Sampo KM-711 (15.9)	Panasonic Pana-Sync S17 (16)	Panasonic Pana-Sync S15 (14)	Seenix KM-520 (14)	Sampo KM-511 (14)	Sys SPM-15-MS (14)
Installed external RAM cache and type	512K pipelined-burst	512K synchronous	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
Motherboard manufacturer and model	ASUSTek TX97-E	ASUSTek KN-97-X	ASUSTek TX97-X	SuperMicro P6SNE II	SuperMicro P5MMA98	Yokon TX-10	ASUSTek TX97-X	ASUSTek KN97-X
Chip set	Intel 430TX	Intel 440FX	Intel 430TX	Intel 440FX	Intel 430TX	Intel 430TX	Intel 430TX	Intel 440FX
BIOS manufacturer and version (or date)	Award 4.51PG	Award (5/21/97)	Award (3/19/97)	AMI (7/15/95)	AMI (7/15/95)	AMI v1.13A	Award (3/19/97)	Award 4.51PG
CD-ROM drive speed and model	7X-12X Toshiba XM-5702B	8X-16X Toshiba XM-6002B	8X-16X Toshiba XM-6002B	12X-24X TEAC CD-524E	12X-24X TEAC CD-524E	16X Mitsumi CRMC-FX-240S	8X-16X Toshiba XM-6002B	12X-24X TEAC CD-524E

Networking, Communications, and Management Features

Network adapter	3Com Fast EtherLink XL	3Com 3C905-TX	3Com 3C905-TX	3Com Fast EtherLink XL	3Com Fast EtherLink XL	3Com Fast EtherLink XL	Digital CWL9512	3Com Fast EtherLink XL
Desktop management software	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0
Remote management implemented	■	■	■	■	■	■	■	■

Expandability

Maximum RAM	512MB	384MB	256MB	768MB	256MB	128MB	256MB	640MB
Expansion-bus slots	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA
Front-accessible drive bays (5.25" / 3.5")	4 / 1	3 / 2	3 / 2	3 / 2	3 / 2	3 / 2	3 / 2	3 / 2
Internal drive bays (5.25" / 3.5")	0 / 3	0 / 1	0 / 1	0 / 3	0 / 2	0 / 2	0 / 1	0 / 3
Power-supply wattage	250	250	250	230	235	250	235	235
Parallel/serial ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 1	1 / 2	1 / 2
Mouse/USB ports	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2

Service and Support

24-hour, 7-day live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	3 years/3 years	3 years/5 years	3 years/5 years	3 years/1 year	3 years/1 year	5 years/3 years	3 years/3 years	Varies/1 year
On-site service charge for 1 year	\$50	\$75	\$75	Included	Included	\$99	Included	Included
24-hour turnaround for parts replacement	N/A	■	■	■	■	■	■	■

N/A—Not applicable. The product does not have this feature.

factor. Both use a bus slot riser card, but the XL cannot accept full-length ISA cards because of the position of its CPU.

The systems do not offer much room for expansion (the XL has two open bays, and the PL only one), but each has two USB ports and an integrated speaker. Their 4GB hard disks—which use SMART technology and the Ultra ATA interface—cannot use the Ultra DMA protocol because neither machine has the latest in Intel chip sets: The Pentium II-based XL has the

440FX (not the LX), and the PL Pentium model has the 430HX (not the TX). Both were average performers.

IBM ships these PCs with integrated 10/100 Ethernet and copies of Lotus Smart Suite 97. IBM has covered most every base with these systems but tagged them with somewhat expensive prices.—CM

IBM Personal Computer Co., Research Triangle Park, NC; 800-426-2968; fax, 800-426-3395; www.pc.ibm.com. Circle 462 on reader service card.

Maximus Magna Media

Pentium MMX/200, 6GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 16.6. \$3,880 direct.

Maximus Computers' Magna Media garnered very good performance results for its mainstream class. It comes with some very high-end hardware—especially its 14-inch active-color LCD—which accounts for its above-average price. Not all of its components can be fully monitored, however.

COVER STORY
Managed Corporate PCs

See www.pcmag.com for interactive views

Ends

Sys Performance 233M2	Toshiba Equium 6230D	Toshiba Equium 5200D	Total Peripherals Serengeti-200MX	Unitek UT-PII266 Provider	Zenon Dream Media Plus
Mainstream	High-end	Mainstream	Mainstream	High-end	Mainstream
\$1,749 direct	\$2,600 street	\$1,960 street	\$1,930 street	\$2,999 direct	\$2,699 direct
Cyrix 6x86MX-PR233	Pentium II/233	Pentium MMX/200	Pentium MMX/233	Pentium II/266	Pentium MMX/233
SDRAM	EDO DRAM	EDO DRAM	SDRAM	EDO DRAM	EDO DRAM
IBM DHEA-36480	Maxtor 83240D4	Maxtor 84000A6	Quantum Fireball ST	Quantum Fireball ST	Maxtor 87000D8
6.1GB Ultra ATA	3GB Ultra ATA	3.7GB ATA-3	3GB Ultra ATA	6.2GB Ultra ATA	6.5GB Ultra ATA
Number Nine Revolution 3D (PCI)	ATI All-in-Wonder (PCI)	Integrated (PCI)	Matrox Millennium II (PCI)	Matrox Millennium II (PCI)	ATI 3D Xpression Plus (PCI)
4MB WRAM	4MB EDO DRAM	2MB EDO SGRAM	4MB WRAM	4MB WRAM	4MB SGRAM
Number Nine Ticket2Ride	ATI 3D Rage II DVD	ATI 3D Rage II	Matrox MGA-2164WP-C	Matrox MGA-2164WP-C	ATI 3D Rage II + DVD
Sys SPM-15-MS (14)	Toshiba DP566M (14)	Toshiba DP566M (14)	GoldStar Studio-works 56M (14.1)	ViewSonic PT775 (16.1)	MAG DJ530 (14)
512K pipelined-burst	512K pipelined-burst	256K pipelined-burst	512K pipelined-burst	512K pipelined-burst	512K pipelined-burst
ASUSek TX97-X	Intel Dublin	Intel Cumberland	ASUSek TX 97-X	Intel PD440FX	SuperMicro P5MMA
Intel 430TX	Intel 440FX	Intel 430HX	Intel 430TX	Intel 440FX	Intel 430TX
Award 4.51PG	AMI/Intel v1.00.01 DU08	AMI v1.00.03 DK08	Award (1/6/97)	AMI 1.00.03.DT0	AMI 0708971500
12X-16X TEAC CD-518E	12X-24X Toshiba XM-6102B	7X-12X Toshiba XM-5702B	12X-24X Acer 924E	7X-12X Toshiba XM-5702B	10X-16X Multi-media Technology CDM-H302
3Com Fast EtherLink XL	Intel EtherExpress Pro/100B	Intel EtherExpress Pro/100B	3Com Fast EtherLink XL	Intel EtherExpress Pro/100B	3Com 3C905-TX
Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0	Intel LANDesk 3.0
256MB	384MB	256MB	256MB	256MB	256MB
3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 1 PCI, 1 PCI/ISA	2 ISA, 1 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA
3/2	2/1	2/1	3/2	3/2	3/2
0/3	0/1	0/1	0/1	0/3	0/1
235	200	145	235	235	235
1/2	1/1	1/1	1/2	1/2	1/2
1/2	1/2	1/2	1/2	1/2	1/2
Varies/1 year	3 years/3 years	3 years/3 years	3 years/1 year	1 year/1 year	1 year/1 year
Included	Included	Included	Included	\$75	\$199
	N/A	N/A			

The LANDesk 3.0 software was able to report on the system's disk drives but did not return information on the unit's Intel EtherExpress Pro/100 NIC, graphics card, CPU, and memory. However, the software was able to monitor motherboard hardware and report on component failures and thermal alerts.

Instead of a standard CRT monitor, the unit included a slim ViewSonic VP140 XGA display with a 14-inch screen that offers the same viewable area as a 15-inch

monitor. The system would cost \$2,350 with a 15-inch CRT monitor.

Graphics are high-powered with the Number Nine Revolution 3D graphics board with 8MB WRAM. Other hardware includes a Ultra ATA hard disk and a 24X Toshiba CD-ROM drive. The ATX-style motherboard is based on the Intel 430TX chip set. With these components, the unit yielded above-average Business Disk, Business Graphics, and CD-ROM WinMark 98 results. Its Winstone and CPU-

mark₃₂ scores were average.

Maximus's warranty covers one year on parts and one year on labor, with a year of free on-site service. Toll-free technical support is available 24 hours, 7 days for the first year; after that, it is during business hours six days a week. Updated software drivers are on the company's Web site. The Magna Media has strong performance but provides limited data for management.—RSA

Maximus Computers, Irwindale, CA; 800-888-6294, 626-815-7777; fax, 626-969-2775; www.maximuspc.com. Circle 496 on reader service card.

Mega Impact PentiumII266/64+, PentiumMMX200+

PentiumII266/64+: Pentium II/266, 4.8GB hard disk, 15-inch monitor, EDO DRAM, High-End Winstone 98: 28.4, \$2,590 street.

PentiumMMX200+: Pentium MMX/200, 4GB hard disk, 15-inch monitor, SDRAM, Business Winstone: 15.8, \$1,730 street.

Mega Computer Systems offers its attractively inexpensive corporate PCs both direct and through resellers. But neither the high-end Impact PentiumII266/64+ nor the mainstream Impact PentiumMMX200+ can monitor the fan, temperature, or voltage since both lack the LM78 ASIC.

Although both of these systems arrived at PC Labs with the Norton Administrator software monitor loaded rather than Intel's LANDesk Client Manager, Mega does ship LANDesk with its systems upon request. After loading LANDesk 3.0, we found that the PentiumII/266/64+ provides information on a fair number of hardware components but the PentiumMMX200+ provides almost no useful DMI system data.

The PentiumMMX200+ is an ATX desktop model equipped with the Intel 430TX chip set and 512K of L2 cache. Four empty SIMM slots and a single occupied DIMM slot, which cannot be used concurrently, are nestled behind the system's hard disk, power supply, and power cables—sure to be an inconvenience during upgrades. The PentiumMMX200+ offers reasonable room for expansion but has no free IRQs. Though equipped with a Millennium II graphics card (4MB of WRAM), this mainstream managed PC was a below-average performer under Graphics WinMark. All other scores were average.

Managed Corporate PCs

tium MMX/233 ClientPro MRE and the high-end corporate Pentium II/266 ClientPro XLU feature mechanical intrusion detectors. The units' tool-free cases facilitate servicing and upgrades. Each one also has an LM78 ASIC on the motherboard to monitor fan status, temperature, and motherboard voltage. The ClientPro MRE came with a Creative Labs Sound Blaster 16 sound board, while the ClientPro XLU used a motherboard-integrated audio system based on a Yamaha audio chip set.

On our benchmark tests, the ClientPro MRE was an average performer, except on the CD-ROM WinMark 98 test, where its Hitachi 24X CD-ROM drive yielded the top score for a mainstream corporate PC. In its high-end corporate class, the ClientPro XLU was an average performer, except for a below-average score on our High-End Graphics WinMark 98 test.

Micron offers a three-year warranty on most components; processor and memory are covered for five years. Micron includes a year of free on-site service, as well as 24-hour technical support. Its Web site offers a deep library of drivers and component documentation.

A high level of remote manageability and adequate performance make these ClientPro units solid choices.—RSA

Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-893-3343; fax, 208-898-7333; www.micronpc.com. Circle 472 on reader service card.

Micro X MXP-5100

Pentium MMX/233, 4.1GB hard disk, 17-inch monitor, SDRAM, Business Winstone 98: 17.5. \$2,499 direct.

The Micro X MXP-5100 offers mostly average management features. Those looking for good performance without breaking the bank may find this a compelling corporate mainstream system.

For servicing, the MXP-5100's motherboard and cards slide right out of the back of the case. The system accepts both SIMMs and DIMMs. Our test unit could provide information on most system components through its Wizard 95 1.0 DMI software, and it came with the LM78 ASIC for hardware monitoring. However, the fan was plugged directly into the power supply, not the motherboard, leading to incorrect reports about its status.

The BIOS will be upgraded, an intrusion alert added, and the fan sensors should be working by the time you read this, according to the company. A 3Com 10/100 Ethernet adapter provides connectivity.

Lotus SmartSuite 97 is bundled with the system; you also get a ten-CD pack, but most of those titles are games. The Juster speakers and subwoofer (optional; price included above) are better suited to a home office than a corporate environment.

The system earned above-average scores on our Winstone and Graphics WinMark 98 tests because of its 430TX chip set and its 8MB Matrox Millennium II graphics card. Other scores were average.

The system has a five-year labor and three-year parts warranty. On-site service is free the first year. Technical support is available 9:00 to 7:00 weekdays and 10:00 to 3:00 Saturdays, eastern time.

Small or home offices should seriously consider the MXP-5100, and if the system is upgraded as promised, some corporate users may be satisfied as well.—FJE

Micro X, Solon, OH; 800-736-4276, 216-498-3330; fax, 216-498-3520; www.microx.com. Circle 471 on reader service card.

NEC PowerMate Professional, Enterprise Series Managed PC

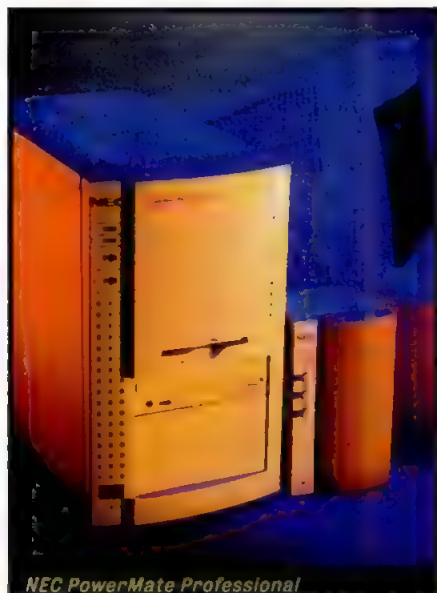
PowerMate Professional: Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM. High-End Winstone 98: 27.3. \$2,889 direct.

Enterprise Series Managed PC: Pentium MMX/233, 6.2GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 18.1. \$1,998 direct.

NEC Computer Systems Division of Packard Bell NEC offers two units that have great management features: the mainstream NEC Enterprise Series Managed PC and the high-end NEC PowerMate Professional.

Both units came with Intel's LAN-Desk Client Manager 3.0 (Version 3.1 will be shipping by December 1, 1997). Version 3.0 was able to monitor and browse all of the components in the PowerMate Professional but did not detect the graphics or network cards in the Managed PC. Both units have the LM78 ASIC, which monitors fans, case temperature, and voltage on the motherboard. Both also have Wake-on-LAN capability, chassis intrusion alarms, and infrared ports.

The Managed PC, a slim desktop, is a



NEC PowerMate Professional

The PentiumII266/64+ is a roomy ATX midtower, offering more expansion room than its sibling and eight free IRQs. Its performance was uniformly average except during CD-ROM WinMark 98 testing, when its 12X/24X Matsushita drive earned the top scores in its class.

Both PCs ship with a 3Com Fast Ethernet card and two USB ports (not integrated on the motherboard, but supplied through a cable). The vendor provides a two-year warranty; no on-site service is available, but toll-free technical support operates during business hours weekdays. While both systems are eminently affordable, only the PentiumII266/64+ offers basic manageability features.—CM

Mega Computer Systems, San Diego, CA; 800-338-6628, 619-487-8888; fax, 619-485-1518; www.megacs.com. Circle 469 on reader service card.

Micron ClientPro XLU, MRE

ClientPro XLU: Pentium II/266, 4GB disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 25.6. \$2,993 direct.

ClientPro MRE: Pentium MMX/233, 3GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 17.6. \$1,949 direct.

Micron Electronics' two corporate entries provide a high degree of manageability as well as competitive performance within their classes. The units came with Intel's LANdesk 3.1 software, which was able to browse and monitor all major components in both machines. The Intel EtherExpress Pro/100 Ethernet adapters bundled with both units support the Wake-on-LAN capability of LANdesk 3.1.

Both the mainstream corporate Pen-

Partners Series

The Microsoft Windows PC

?

**Windows NT
Workstation:**

**Is it right for your
size business?**

Inside:



In the market for a new business PC?

**Why pre-installed Microsoft Windows NT Workstation
is your best business move yet.**

If there's one thing to be learned from the explosive growth in the number of small businesses, it's that size and success aren't necessarily related. Given the right tools, a small business can perform just like a big business. The bottom line? You don't have to be big to do big things.

Keeping that in mind, Microsoft—with our PC partners Dell, Digital, IBM, and others—has created a business computing solution that can change the way businesses of all sizes work and succeed. It's Windows NT pre-installed on new PCs.

We can guess your next question: "Isn't Windows NT just for enterprises?" The fact is, no it's not. We believe Windows NT is the world's most powerful business operating system. And small businesses everywhere are using this power on new PCs with big results. Why did they choose Windows NT Workstation? Here's what they told us.

"Windows NT allows my small company to do the work of a large company."

—Arabian, Hypnotic Fx

Windows NT Workstation is dependable. "Small businesses are no different from big corporations in one important respect," says Alton Loe of OSI. "Our computers need to run just as dependably. That's why we like Windows NT. It's bulletproof." Greg Hillenbrand of Fourth Shift concurs. "For us, running Windows NT on IBM ThinkPads was a no-brainer. We've been using ThinkPads for four years—but with Windows NT, we were suddenly able to do things we'd never done before. Windows NT is safe. It's stable. It doesn't disappoint us."

Windows NT keeps your data safe and secure even under the very toughest conditions. Ever accidentally leave your laptop in a cab? Or find out that someone who shouldn't have accessed your files did? We have, too. That's why Windows NT includes integrated security. This way more than one person can use the same personal computer, but each has access only to his or her individual files. "The key reasons we had Windows NT pre-installed on our new PCs was its security and scalability," says Mike Stone, Stan Wiley Realtors. "In our business, data integrity is paramount. Windows NT allows us to guarantee complete customer privacy, as only agents with a need to know can access customer information—even on our shared PCs."

Windows NT is not complicated. Windows NT features the same familiar user interface that is in the Windows 95 operating system. "The Windows NT user interface makes everything easy," says Leoung O'Young of Digimata. "We just finished a project that, just a few years ago, we couldn't have even attempted. But now that we have a Digital Personal Workstation running

Yes!
Windows NT
Workstation
is right for
businesses
of *all* sizes.

Windows NT, we can take on big projects and really deliver." Jan Denson of Pillsbury Madison Sutro LLT agrees, having recently migrated the firm to a Dell OptiPlex PC and Windows NT environment. "It hasn't been hard at all to learn Windows NT—and we've got people here who, five hours before they got their system, didn't even know what a mouse was. A little bit of training, and they're up and running. That's how easy Windows NT is."

Windows NT is a multitasking wonder. What about doing multiple tasks at once? Windows NT preemptive multitasking allows you to work fast and furiously in several applications at the same time without worrying about overloading the system. "Windows NT task switching is ... bam! It's immediate," says Loe. "Windows NT runs every application in a separate memory space, so it's like having a virtual machine for each task."

Windows NT turns you into a brilliant manager of files, folders, applications—and time. Hate filing? That's okay. Windows NT presents a view of information that makes browsing and managing files, drives, and network connections easy—and your time even more productive. "We're able to get more work done in less time; we know the status of everything. And with our Digital Personal Workstation, the 3-D work really screams," says Arabian, owner of Hypnotic Fx.

Windows NT saves big bucks. Industry analysts report that running Windows NT costs a lot less than running Windows 3.1.* And don't forget the time saved by not calling technical support and how much more work your firm can accomplish—and bill—due to increased productivity. "When you consider the return on investment," adds Loe, "you've really got to ask yourself, can I afford not to go with Windows NT?"

Windows NT is the best way to move your business into the future: a 32-bit world. Besides increased security, better performance, bulletproof reliability, and reduced costs, what else can a 32-bit operating system like Windows NT offer? Well, how about the satisfaction of a secure investment? As Denson points out, "We did the research, and it was clear to us that 32-bit was the only way to go. This was a strategic decision—our goal was to buy on the forward edge of technology." What did their research tell them? "All indicators pointed to a 32-bit environment running Windows NT."

Windows NT has a way of helping businesses of all sizes accomplish one important task: success. "It's funny," summarizes Arabian. "A lot of people think Windows NT is just for large businesses, but I think it's actually the other way around. Windows NT is the way in. Being successful has little to do with size and everything to do with how quickly you move. And I can tell you this much: With Windows NT, we're moving pretty fast."

From our partners

Dell: built for your business. At Dell, we talk with thousands of business customers every day, and this is what we've heard. You want a powerful machine that won't become obsolete within a year (or even five). You want it configured for your specific needs. And you want it at a fair price. How do we respond to these requests? With one word: OptiPlex.



The OptiPlex system, like all of our other offerings, isn't something we pull from stock. We build it in the exact configuration you want, fully loaded with the software you spec, from the ground up. Today, more businesses are requesting OptiPlex computers pre-loaded with Windows NT Workstation than ever before, and we think that's smart. Windows NT is a powerfully robust system, and we should know—our validation lab puts it through its paces every day. But our partnership with Microsoft goes well beyond meetings and tests. We're also working with it to create a computing road map designed to give you the ability to see further. Like all the way to the future. Long before it arrives.

Digital: approaching warp speed. At Digital, we see a tremendous opportunity for businesses of all sizes to sharpen their competitive edge by moving to powerful Windows NT-based workstations. Built for the demanding design professional, our Digital Personal Workstations can drive down costs, improve productivity, and help you harness the latest, most innovative 32-bit applications. And the results are impressive.



Digital Personal Workstations unleash the true power of Windows NT Workstation to help users visualize their creations faster and more realistically. At the same time, they offer access to state-of-the-art office and personal productivity tools. It all adds up to faster time to market. Even better, the combination of Digital Personal Workstations and Windows NT offers a total cost of ownership that is 39 percent lower than that of UNIX workstations, according to a study conducted by Deloitte and Touche. See what we mean? Impressive results. And exactly what you would expect from a powerful alliance between two market leaders: Digital and Microsoft.

IBM: think smart. At IBM, we're dedicated to helping our customers get the most out of their computing solutions, and our ThinkPads are a perfect example. Working closely with Microsoft, we designed all our ThinkPads to take on the very real challenge of running Windows NT Workstation on a notebook computer—and we're happy to report that the long hours have resulted in a smashing success.



Today, while all our ThinkPads run Windows NT, the IBM ThinkPad 770 provides what we believe is the industry's premier Windows NT Workstation implementation in a mobile platform. Every ThinkPad 770 features, among other things, full power management, Ultrabay Plug and Play, and hot plug PC Card support. Bottom line? Our customers can take advantage of Windows NT security, scalability, and reliability at 35,000 feet as easily as they can on their desktop system back at the office. Flexibility through partnership. At IBM and Microsoft, it's what we think small businesses need to succeed.

For more information on
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Managed Corporate PCs

service technician's dream. Pulling two plastic latches allows the motherboard to slide out, providing easy access to a neatly laid out interior. The unit includes an integrated audio subsystem with a Yamaha OPL chip set and an Intel EtherExpress Pro/100B Ethernet card. The motherboard carries an integrated S3 graphics chip set; on our test unit, the chip set was disabled in favor of a Number Nine Revolution 3D graphics card with 4MB of WRAM. The PowerMate Professional comes in a wide midtower case with a 3Com EtherLinkIII Ethernet adapter and a Number Nine Revolution 3D graphics card with 8MB of WRAM.

The Managed PC yielded above-average scores on our Business Disk and Business Graphics WinMark 98 tests, as well as on our Business Winstone 98 test. Its CD-ROM WinMark 98 score was average. The Professional logged an above-average score on our High-End Graphics WinMark 98 test and a below-average mark on our High-End Disk WinMark 98 test. Other scores were average.

NEC offers round-the-clock technical support and backs the machines with a three-year warranty that includes a year of on-site service. The company's Web site offers technical support documentation as well as driver software. Both units are very manageable, and the Managed PC is particularly easy to service.—*RSA*
NEC Computer Systems Division, Packard Bell NEC Inc., Mountain View, CA; 888-863-2669, 650-528-6000; fax, 650-528-5350; www.nec-computers.com. Circle 473 on reader service card.

Nova PII-266XC, K6-200C

Nova PII-266XC: Pentium II/266, 4.9GB hard disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 27.3. \$2,499 direct.

Nova K6-200C: AMD K6/200, 4.9GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 17.1. \$1,799 direct.

Nova Computers offers two attractively priced corporate PCs: its high-end Nova PII-266XC and mainstream Nova K6200C midtowers. The high-end unit provides a fuller array of management features.

The units included Intel's LANDesk Client Manager 3.0 software, which was able to browse all components on our test PII-266XC but did not identify the graphics, network, or sound cards in the

K6200C. Both systems came with the LM78 ASIC for monitoring hardware. The K6200C's memory slots were blocked by cables; otherwise, the internal components were accessible. Neither system had a tool-free chassis.

The K6200C is configured with a 3Com 10/100 EtherLink XL Ethernet adapter. Its ASUSTek motherboard has a PCI slot with a MediaBus extension, which works with a proprietary combination graphics/sound board. The PII-266XC midtower has the same network card as the K6200C but comes with an Intel motherboard that has integrated audio circuitry and two USB ports. The PII-266XC's motherboard can slide out after a few screws are removed. Both units come with a large bundle of software, including Lotus SmartSuite 97, the 1997 Grolier Multimedia Encyclopedia, and McAfee VirusScan.

The K6200C fared well on our tests, logging average scores for its class all around. The PII-266XC had the best High-End Graphics WinMark 98 score among high-end corporate PCs; its other benchmark scores were average.

Nova Computers offers a three-year parts and labor warranty with the units; on-site service is \$50 per year. Technical support is available during extended business hours on weekdays, but the company's Web site lacks software and technical support documentation. (Nova claims the site will be updated to include both by the time you read this.) Both systems offer adequate management features, but the Nova PII-266XC clearly offers more.—*RSA*

Nova Computers Inc., Wickliffe, OH; 800-461-1168, 216-516-3030; fax, 216-516-3040; www.novacompinc.com. Circle 475 on reader service card.

Polywell Poly 7266S1, 500TX1

Poly 7266S1: Pentium II/266, 4.9GB hard disk, 17-inch monitor, EDO DRAM. High-End Winstone 98: 28.1. \$2,759 direct.

Poly 500TX1: Pentium MMX/233, 4.9GB hard disk, 17-inch monitor, SDRAM. Business Winstone 98: 17.5. \$1,998 direct.

Polywell Computers offers two functional corporate PCs: the mainstream Poly 500TX1, which garnered average performance results on our benchmark tests, and the high-end Poly 7266S1, which



Nova PII-266XC

yielded superb graphics performance.

Both charcoal-colored midtowers come with Intel's LANDesk Client Manager 3.0 (Version 3.1 should be available by the time you read this). Version 3.0, however, was able to browse and monitor most components in both systems. Both units come with the LM78 ASIC for monitoring hardware. LANDesk did not detect the network card in either unit or the graphics card in the Poly 500TX1.

Both units allow clear access to their motherboards; the chassis are not tool-free, however. Each has a 3Com 10/100 Ethernet board, a GVC 33.6-Kbps fax modem (upgradable to K56flex), and a set of QuickShot speakers.

The Poly 500TX1 comes with an ASUSTek motherboard that has an integrated audio subsystem with a Creative Labs Vibra 16 chip set. The high-end Poly 7266S1 also has an ASUSTek motherboard, but its sound comes from a Crystal 16 3D sound board. Expansion options on both systems are good.

The Poly 500TX1 yielded average scores on our tests. The Poly 7266S1 posted an above-average score on our High-End Graphics WinMark 98 test thanks to a Matrox Millennium II graphics board with 8MB of WRAM. Its remaining scores were average.

Polywell covers the units with a three-year parts and five-year labor warranty. A year of on-site service is \$75. Its Web site links to other sites with drivers and support files. Both units offer average management and solid performance, especially in graphics for the Poly 7255S1.—*RSA*
Polywell Computers Inc., South San Fran-

Managed Corporate PCs

LANDesk machines we tested cannot do. Both also have SMART hard disks.

The Polaris's motherboard is an older model that lacks integrated USB ports; other I/O ports are also not integrated on the motherboard. An off-board parallel port obstructs one of the PCI slots, though the system does have eight free IRQs and five free drive bays. The Discover has no free IRQs, but other expansion options are good.

The Polaris was an average performer. Its graphics card and Panasonic monitor provide excellent visuals—if only up to 1,024-by-768 resolution. At 1,280-by-1,024 with 24-bit color (at the default 75-Hz refresh rate), the monitor was unreadable. The Discover was mostly an average performer, except for an above-average Business Graphics WinMark 98 score.

Both units also ship with a 56.6-Kbps K56flex modem and a Microsoft ergonomic keyboard. Technical support is available during business hours weekdays, and the units have a three year warranty with one year of on-site service.—**CM**
ProGen Systems, Tustin, CA; 800-848-1353, 714-566-9200; fax, 714-566-9267; www.progen.com. *Circle 479 on reader service card.*

Seanix TCOe 200

Pentium MMX/200, 2.9GB hard disk, 17-inch monitor, SDRAM. Business Winstone: 15.3. \$1,594 direct.

Through its new U.S. sales division in Iowa, Seanix—Canada's largest PC manufacturer—markets the mainstream TCOe 200. System monitoring could be more complete, but buyers will appreciate the system's bundled software, its extended warranty, and—best of all—its low price.

Network connectivity comes from a 3Com fast EtherLink card. Intel's LANDesk 3.0 DMI software provides system data, but because there is no hardware monitor chip, you get no information on fan status, temperature, and motherboard voltages. Servicing is easy: Components are accessible, and the motherboard can be dropped out of the rear.

We encountered a problem with the sleep button in the machine, which the vendor claims to have corrected. While we weren't able to test the fix, the button should now actually put the unit into sus-

pend mode. The system comes with McAfee VirusScan and a choice of Lotus SmartSuite 97 or Corel WordPerfect Suite 8. The unit's test scores were mostly average; the disk score was below average, however.

Parts and labor for the main components—including motherboard, CPU, and video card—are covered for five years; other components are covered for three. Technical support is limited to business hours on weekdays. Seanix's Web site provides access to drivers, which is helpful since Seanix designed and built most of the components, including the graphics card and the Intel 430TX-based motherboard.

The unit's great software, extended warranty, and low price add up to a reasonable management solution.—**FJE**

Seanix Technology Inc., Sioux City, IA; 888-252-1190, 712-255-3733; fax, 712-233-3278; www.seanix.com. *Circle 483 on reader service card.*

SMD Mount Hood MMX

AMD K6/200, 3GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 17.6. \$1,650 direct. Intended for mainstream corporate installations, the SMD Mount Hood MMX uses AMD's K6 CPU to provide Pentium-level performance at an astonishingly low price. Its DMI implementation, provided by ASUS Computer International—one of Intel's primary LANDesk Client Manager OEMs—is fairly good.

An embedded LM78 chip and a copy of LANDesk Client Manager 3.0 provide fan, temperature, and voltage monitoring, along with detailed information on almost all of the system's components except its Cardware Labs Ethernet card and Matrox Mystique 3D graphics card. The company did not announce when it will ship LANDesk 3.1. The tested unit couldn't detect chassis intrusion (Summit will provide such technology free upon request), but it did have a SMART hard disk.

The system's three DIMM slots and CPU reside behind the power supply and thus are difficult to access, but internal cables are tethered and kept out of the way. All 16 IRQs are used; otherwise, expansion options are good.

Despite being compared with a group of predominantly 233-MHz systems, the



Seanix TCOe 200

cisco, CA; 800-999-1278, 650-583-7222; fax, 650-583-1974; www.polywell.com. *Circle 477 on reader service card.*

ProGen Polaris 266NT, Discover3D 233

Polaris 266NT: Pentium II/266, 4.9GB disk, 17-inch monitor, EDO DRAM. High-End Winstone: 26.8. \$2,499 direct.

Discover3D 233: Pentium/233, 4GB hard disk, 15-inch monitor, EDO DRAM. Business Winstone: 16.5. \$1,699 direct.

The two offerings from ProGen—the mainstream Discover3D 233 and the high-end Polaris 266NT—are inexpensive machines with average performance and some noteworthy extras. Both are functional managed PCs.

Both mini-towers came to us with the Administrator Console version of LANDesk Client Manager 3.0 loaded rather than the Local version. Once we had reinstalled the software, we saw two very different DMI implementations. The Polaris's motherboard uses a System Management Port card to monitor fans, temperatures, and voltages, whereas the Discover's motherboard uses the LM78 ASIC. Each method worked well, although because the Discover's CPU fan was plugged directly into the power supply rather than the motherboard, LANdesk incorrectly issued a perpetual CPU fan-warning alarm.

Both ProGen's are unable to offer I/O, CPU, and memory attribute information under LANdesk, though the Polaris does provide data concerning its graphics card and 3Com network card—something most

WALL ST

1 IN A FREE MARKET ECONOMY, companies are always competing for capital. In fact, the market has never been more competitive than it is today. This increases the number of specialists needed to trade stocks. It also puts an additional burden on the technology needed to support them.

2 THE TRADING FLOOR is crowded with specialists. The trading floor is also crowded with big, bulky CRTs that hog energy, take up precious room and throw off a lot of heat. (Besides, as any trader will quickly tell you, it's already "hot" enough on the trading floor.)



3 REPLACING A BIG, BULKY CRT with a slim flat panel display actually makes room for more traders on the floor. Which is a good thing, since the trading volume on the major exchanges is higher than ever.

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4 MORE TRADERS MEANS MORE TRADES, which means more money. (And let's be completely frank, shall we, what financial person doesn't like news like that?) In fact, one could even argue that migrating from big, bulky CRTs to slim flat panel monitors like the MultiSync LCD2000 could actually put a positive spin on the term 'downsizing.'



NEC MultiSync LCD2000
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On Wall Street at least, it appears that less may actually be more. Replacing big, bulky CRTs with flat panel displays makes room for more traders on the floor. For example, take NEC Technologies' new MultiSync® LCD monitors, including the world's first commercially available 20.1" viewable LCD monitor.

viewing at the screen at virtually any angle. These monitors produce a brighter, sharper image than many CRTs. They eliminate eye-fatiguing flicker. They also consume up to 50% less power and have much lower emissions. Plus, these revolutionary monitors are compatible with most PCs, Macs and workstations.

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200-MHz Mount Hood produced average- to above-average scores. Like other mainstream K6 systems, it bettered most of the competition under CPUmark₃₂ and had an exemplary CD-ROM WinMark 98 score.

The system has a three-year parts and one-year labor warranty with one year of on-site service. The technical support line is open weekdays during business hours. Though it lacks a tool-free chassis, this is a fine machine sold at a fine price.—**CM Summit Micro Design Inc.**, San Jose, CA; 800-288-5828, 408-278-8728; fax, 408-278-8724; www.smd-hq.com. **Circle 497 on reader service card.**

Sys Performance Pro 266A, 233M2

Performance Pro 266A: Pentium II/266, 6.1GB disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 28.7. \$2,349 direct.

Performance 233M2: CX 6x86MX-PR233, 6.1GB hard disk, 15-inch monitor, SDRAM. Business Winstone 98: 19.5. \$1,749 direct.

Sys Technology, a direct PC seller, is one of the few vendors reviewed here to offer units with both an Intel CPU and one from an Intel competitor. The Sys Performance 233M2 is based on Cyrix's new 6x86MX-PR233, an 188-MHz chip with performance comparable to that of the Pentium/233 with MMX Technology (for some functions, the chip is also comparable with the 233-MHz AMD K6 and Intel Pentium II).

This machine and its high-end corporate sibling, the Sys Performance Pro 266A, supply reasonable LANdesk Client Manager DMI implementations and mostly average performance. Sys, however, sells few LANdesk-based managed PCs like the two reviewed here; it says its focus is typically on fast, standalone SCSI machines.

The 233M2 and the Pro 266A have motherboards and DMI solutions from ASUS (complete with LM78 ASICs), and come with 3Com Ethernet 10/100 cards. Both PCs are capable of monitoring system voltages, temperatures, and fan operation.

Though each of these mini-tower systems is equipped with an Ultra ATA hard disk, only the M2 can take advantages of Ultra DMA protocol's 33-MBps transfer

rates. The Pro 266A uses Intel's 440FX chip set, which does not support Ultra DMA. Sys claims it will soon equip the Pro 266A with a Promise Technology disk controller that offers Ultra DMA performance regardless of chip set support. Nevertheless, this machine was the leading performer on the High-End Disk WinMark 98 and the third leading performer under the Business Disk WinMark 98 within its class. The Pro 266A's performance otherwise ranged from average to slightly above.

The 233M2 performed even better than its sibling. Although its 16X TEAC CD-ROM turned in mostly below-average scores, its Business Winstone, disk, and graphics results were all above average.

With these machines, Sys is also introducing its patent-pending Clutter Free cable setup: All system cables are contained in a beige sheath to allow easier access to the motherboard and improve air flow.

Despite the company's claim of little interest in managed PCs, Sys has produced two good, well-priced corporate machines.—**CM**

Sys Technology Inc., Cypress, CA; 800-613-9963, 714-821-3900; fax, 714-821-9592; www.systechology.com. **Circle 484 on reader service card.**

Toshiba Equium 6230D, 5200D

Equium 6230D: Pentium II MMX/233, 3GB hard disk, 15-inch monitor, EDO DRAM. High-End Winstone 98: 25.1. \$2,600 street.

Equium 5200D: Pentium MMX/200, 3.7GB disk, 15-inch monitor, EDO DRAM. Business Winstone 98: 15.5. \$1,960 street.

A player in the North American corporate PC market since March of 1997, Toshiba has designed two appealing managed PCs. Equipped with second-tier clock speeds—200 MHz for the mainstream 5200D and 233 MHz for the high-end 6230D—these machines aren't distinguished performers, but they do boast fine LANdesk Client Manager 3.0 DMI solutions.

Both the 5200D and the 6230D have tool-free desktop chassis. You can easily remove the sturdy covers by pressing two



buttons on either side of the machine and pulling forward. If you do so, however, LANdesk Client Manager will issue an alarm (local, remote, or both)—something few machines reviewed here can do. This excellent LANdesk implementation also monitors fan operations, temperatures, voltages, and provides detailed data on nearly every piece of internal hardware. SMART technology is utilized on the hard disks as well.

Each system has an Intel motherboard with integrated audio and Ethernet. The 6230D also has Wake-on-LAN technology, but unlike the 5200D, it does not integrate its ATI graphics solution. Both systems offer adequate expansion options, and drives in each unit's 3.5-inch bays can be extracted by removing two Phillips-head screws.

Using slower processors than many in this roundup and ATI 3D Rage II graphics chip sets, these PCs performed below average during graphics and CPUmark₃₂ testing; most other major scores were average. Thanks to a 24X Toshiba drive, however, the 6230D's CD-ROM WinMark 98 test result was well above average.

Toshiba ships both Equiums with a helpful electronic user's guide and a three-year warranty that includes one year of on-site service. Technical support is available seven days during limited hours. The company gives 5200D users a choice between Windows for Workgroups and Windows 95 but ships the 6230D with Windows NT. Though not exceedingly fast, these machines are very well constructed and worth a corporate buyer's consideration.—**CM**

Toshiba America Information Systems Inc., Computer Systems Division, Irvine, CA; 800-334-3445; www.equium.toshiba.com. **Circle 498 on reader service card.**

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Managed Corporate PCs

Total Peripherals
Serengeti-200 MX

Pentium MMX/233, 3GB hard disk, 15-inch monitor, SDRAM, Business Winstone 98: 17.1. \$1,930 street.

The Serengeti-200MX offers fairly good management features and is representative of the typical managed corporate PC in this roundup. Its mini-tower has a clear interior and offers room for expansion, but its chassis is not tool-free. It ships with LANDesk Client Manager 3.0 (Version 3.1 will ship when available) and an LM78 ASIC, but it lacks additional features such as a chassis intrusion alarm, SMART hard disk technology, or Wake-on-LAN support.

Like several other tested machines, the Serengeti uses the common LANDesk implementation of its motherboard manufacturer, ASUSTek. The software isn't preloaded, but an installation CD ships with each system. Once the software is installed, it interoperates seamlessly with the motherboard's LM78 ASIC, allowing administrators to monitor temperatures, voltages, and fan failures. A 3Com Fast EtherLink

XL 10/100 network card is included.

The Serengeti, equipped with Intel's TX chip set and an Ultra ATA hard disk, was a mostly average performer for its class. Though equipped with a Matrox Millennium II graphics card (4MB of WRAM), the unit's only below-average score occurred during Graphics WinMark 98 testing.

The company's warranty includes three years on parts and a year of on-site service. Technical support is contracted out to a third party.

The vendor sells the Serengeti directly and via resellers, targeting businesses, schools, and government offices. All in all, this is an average managed system.—*CM Total Peripherals Inc., Northboro, MA; 800-923-7718, 508-393-1777; fax, 508-393-9211; www.totalpc.com. Circle 499 on reader service card.*

Unitek UT-PII266

Pentium II/266, 6.2GB hard disk, 17-inch monitor, EDO DRAM, High-End Winstone 98: 27.1. \$2,999 direct.

Unitek sells the UT-PII266 Provider and its corporate PC siblings through the

direct channel but often fills exclusive government contracts as well. The Provider, which ships with Intel's LANDesk Client Manager 3.0, is an average managed PC.

Unitek's LANDesk 3.0 implementation is typical. The Intel motherboard houses an LM78 ASIC, giving administrators the ability to monitor temperatures, voltages, and fan operation. The system doesn't have a chassis alarm, but its hard disk supports SMART technology.

The midtower's chassis is fairly easy to open, but you need to use a screwdriver. Removing this panel reveals an interior with plenty of room for expansion: Five drive bays are open and four bus slots are unused. Further easing the expansion process are six free IRQs.

The Provider was an average performer on all of our benchmark tests. As these results suggest, its core hardware is standard for this class of machine: Intel's FX chip set, an Ultra ATA hard disk (which, because of the FX chip set, does not benefit from Ultra DMA), a Matrox Millennium II graphics card with 4MB of WRAM, and a Toshiba 12X CD-ROM

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drive. Unitek also includes an Intel Ether-Express Pro/100B adapter.

The company covers parts and labor for only one year, and on-site service is optional (\$75). Technical support is available during business hours weekdays and for a slightly shorter time Saturdays. Web support is nonexistent: Unitek does not have a home page.

The system has an attractive price and good management features, but its service offerings are not as strong as those of others in this roundup.—CM

Unitek Technology Inc., Ontario, CA; 800-944-5650, 909-930-5700; fax, 909-930-5710. Circle 500 on reader service card.

Zenon Dream Media Plus

Pentium MMX/233, 6.5GB hard disk, 15-inch monitor, EDO DRAM. Business Winstone 98: 16.1. \$2,699 direct.

The Zenon Dream Media Plus is aimed at corporate users who need multimedia training units or at business user seeking an all-around system with some high-end functionality. For multimedia training, buyers may prefer a larger monitor, but

otherwise the unit serves the needs of its target audience. It also provides basic management features.

Connectivity is provided by a 3Com 10/100 adapter. Intel's LANdesk 3.0 DMI software was able to browse most components (Version 3.1 will be offered when available). The Dream Media Plus has an LM78 ASIC for hardware monitoring, but since the fans are not connected to the motherboard, the system can't take advantage of the thermal sensors that warn users if the fan dies. The system also lacks a chassis intrusion alarm.

Zenon's unit is a breeze to service. The cards and motherboard slide out of the rear, a design that makes it possible to get to the CPU or memory easily. The unit offers plenty of expansion room.

The unit's scores were mostly average, flanked by an above-average Business Disk WinMark 98 score and a below-average CD-ROM WinMark 98 score.

The system comes with a one-year warranty. On-site service costs \$110 for one year. Technical support is available from 10:00 to 10:00 eastern time on week-



Zenon Dream Media Plus

days and 1:00 to 6:00 Saturdays.

The Dream Media Plus is a fairly good multimedia system with adequate management features. Its service offering, however, is not as extensive as that of others in this roundup.—FJE

Zenon Computer Systems Inc., City of Industry, CA; 800-899-6119, 626-935-1860; fax, 626-935-1826; www.zenontech.com. Circle 501 on reader service card. PC



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Trying to get your head around

AGP?



ATI has long been leading the way in 3D chip and board manufacturing - delivering break-through technology to top OEMs including IBM, DELL, SONY, Gateway, ACER and NEC. So, when Intel launched AGP, who else would you expect to be leading the way with fully-implemented AGP solutions except ATI?

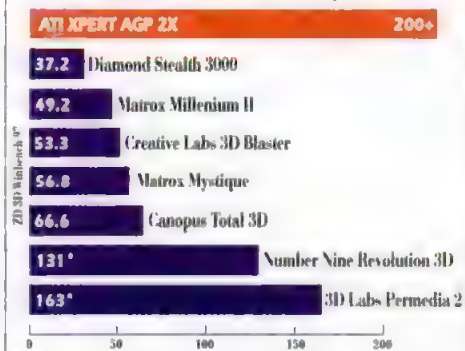
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right now.

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And ATI's XPERT graphic board family, powered by 3D RAGE PRO, also supports the fastest AGP protocol, AGP 2X.

ATI can provide answers and solutions to all your AGP questions. Just as ATI is the leader in PCI, ATI is taking the lead in AGP technology. Being first is second nature

AGP 3D Performance Comparison



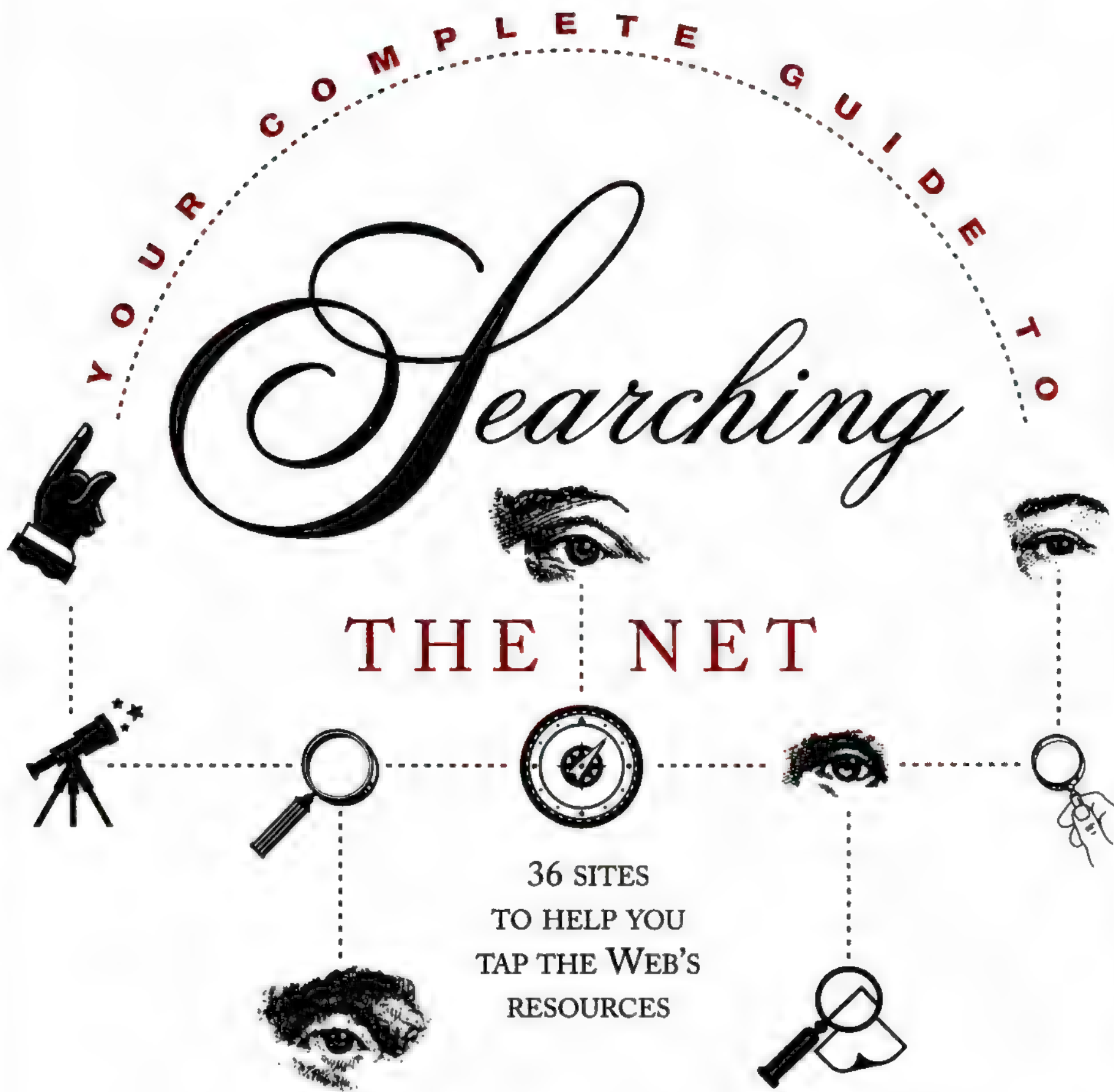
to ATI. The first graphics accelerator, the first DirectDraw, and Direct 3D drivers.

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© Copyright 1997, ATI Technologies Inc. ATI 3D RAGE PRO and XPERT® are trademarks and/or registered trademarks of ATI Technologies Inc. All other company and/or product names are trademarks and/or registered trademarks of their respective manufacturers. 3D Performance Comparison: Tested on Pentium II MMX 266MHz, 32MB/512 cache, Windows 95 OSR2 Test Mode, 640x480x16bpp/87.5Hz. Tested using Driver Version: ATI XPERT AGP 2X 4.1688H+/Diamond Stealth 3000 4.03.00.3205/Matrox Millennium II 4.03.3666/3D Blaster 4.02.026/Matrox Mystique 4.03.00.3411/Canopus 4.03.00.9001
*Reported results

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36 SITES
TO HELP YOU
TAP THE WEB'S
RESOURCES

*T*he days when you could rely on a single search site for all your needs are gone. Along with the rapid growth of the Internet, search functions have specialized to the point where you need a collection of services to unearth essential information quickly and easily.

In the last year, general search sites have

largely abandoned efforts to catalog the entire Net, attempting instead to create directories of sites and ancillary services to help users get to good information quickly. For example, Excite, Infoseek, Lycos, WebCrawler, and Yahoo! now offer such extras as returning suggested keywords to add to your query, providing links to

By David Lidsky and Regina Kwon

Search Indexes and Directories

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related company info and news headlines, and even linking to popular Web commerce sites such as Amazon.com and CDNow. We found these attempts to predict the user's search intentions only occasionally on target, and sometimes simply distracting.

Searching the Net means more than looking for Web sites. The Web has become the place to look up addresses and phone numbers of both individuals and companies, giving you national white and yellow pages right at your desktop. At present, the novelty of these services tempers the lack of complete, current data.

Some may question the utility of searching content as fleeting as that of Usenet newsgroups. But in addition to databases of the current newsfeed, Usenet search sites archive newsgroup content—useful for tracking what people are saying about your company or product.

For sheer convenience, metasearching might be the ultimate tool, letting you query multiple sites simultaneously. The best sites translate complex queries to suit the syntax of each engine and integrate results in a ranked list. But you won't get advanced filtering options or other search extras.

Many of the general search sites utilize these more specialized services, but many of the best tools and options can only be found at the individual sites themselves. Check out these 36 reviews to decide what you need in your suite of Internet search services.

In addition to helping us make sense of the Internet sprawl, search indexes and directories act as a welcome point of reference. Search sites often serve as home pages, a trend those sites are happy to hold on to.

No longer content with providing a simple text box and a database of indexed pages, many sites have added extra features, such as chat, free e-mail, regional guides, and stock quotes. Many sites, such as HotBot, Infoseek, and Yahoo!, now let you search current news databases. And directories—compilations of topics with links to Web sites—often provide much original content, such as staff reviews of sites. Unfortunately, in the push to be Web destinations, some sites have begun to

develop cluttered interfaces, and other, new sites seem to have put more effort into nonessential extras rather than reliable searching.

Our reviews of 12 search sites turned up special talents and egregious mistakes. Read on to discover what is

the best resource for your particular needs.

AltaVista

To take full advantage of AltaVista's power and flexibility, you'll need to spend some time learning advanced search syntax. Though it can't compete with HotBot on power searching, this no-frills site is a good alternative for detailed queries and searches for very specific terms.

On our tests, we found the graphical refine feature quite helpful. Based on your search results, AltaVista dynamically generates a list of topics, which you can then require or exclude. Selecting too many terms, however, can lose relevant hits.

Last year, we criticized AltaVista for its endless, unranked result sets. Now, the site has vastly improved simple searching by adding relevancy ranking. Simple searches support wildcards and phrases and let you require or exclude keywords. Advanced searching offers plenty of options, including Boolean operators, nesting, proximity searching,

and searches limited by date. You won't find any graphical aids, such as HotBot's pull-down menus, to offer assistance in query-building, so you'll want to consult the help pages. You lose automatic relevancy ranking on advanced searches, but you can greatly improve your results by weighting keywords within your query.

Both the simple and the advanced searches let you limit searches to page elements, such as title or URL, or even to a specific domain or Web site. AltaVista also offers foreign-language searching and the ability to customize the search page and set your own defaults.—Nancy Sirapyan

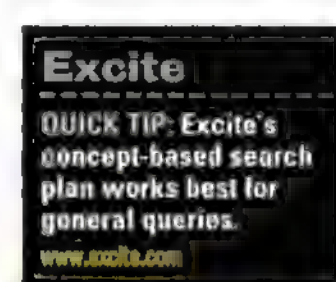
AltaVista. Digital Equipment Corp., Maynard, MA.

Excite

With good returns for simple searches and an array of additional content, Excite is a good choice for less experienced users. Unimpressive results on advanced and current-news queries, however, make this site less useful than HotBot or Yahoo!

On our tests, simple searches often returned useful hits, and the "More Like This" option occasionally helped us get to better returns. Excite dynamically sug-

gests words for refining searches, but we found them sporadically useful. The site occasionally offers links to



sites and Excite categories, but such suggestions are not as frequent or targeted as Infoseek's Best Bets.

For simple searches, you can use natural language and Boolean operators but not wildcards; oddly, Power Search mode doesn't let you use any of those things, although you do get a graphical interface for keyword weighting. Excite has trouble with symbols, as in 401(k). Results pages are set at ten entries, and you can't jump far ahead or back.

Excite is not your best bet for news, even using its News database. Results were often not timely and came from a relatively small range of news sources. We did like Excite's NewsTracker clipping service, in which you can save a search and rerun it as you please, but having the option to set the search to run automatically with results e-mailed to you would be even better.

Covering such topics as Autos, Health,



Come to the PC Magazine Web site for in-depth opinion poll analysis and check out the Virtual Labs for an interactive look at how Internet search sites work.

AltaVista

QUICK TIP: Click on refine | graph for a graphical interface for narrowing your search. altavista.digital.com

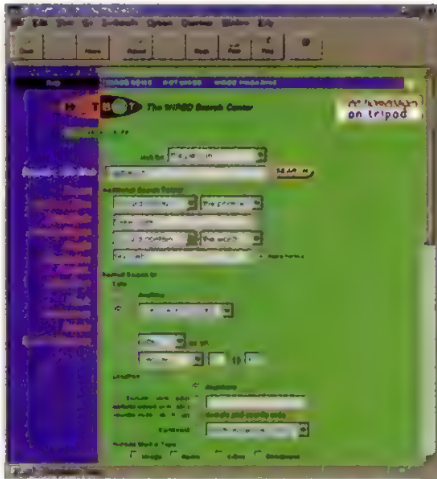
and Travel, Excite's Channels are far less refined than Yahoo!'s directory categories and are sometimes confusing and clumsy to use. Except for News, you can't search within a channel. Excite also provides other services, such as personalization, free e-mail, regional guides, and avatar- and Java-based chat.—*Trevor A. Dawes* **Excite.** Excite Inc., Redwood City, CA.

HotBot



Top-notch news searching, graphical search tools, and a host of filtering options make HotBot a great resource whether you're a beginner or an advanced user.

On our tests, HotBot excelled at current news searching. The NewsBot database, refreshed throughout the day, offers a wealth of data from about 200 sites,



HotBot's detailed graphical search tools put advanced searching at your fingertips.

including the AP and Reuters wires as well as national and international publications. You can also download NewsBot as your own personal news agent.

Of all the sites in this roundup, HotBot offers the most comprehensive list of choices for indexed searching. You can search the Web, Usenet, NewsBot, the

Editors' Choice



• Search Indexes and Directories:

Precision: HotBot
All-Purpose: Yahoo!

• People Finders:

Four11

• Business Finders:

BigBook

• Usenet Search:

Deja News

• Metasearch:

Advanced: ProFusion
Basic: MetaCrawler



Taken together, our Editors' Choice winners comprise a reliable guide for getting the best

information with the least effort.

With an improved interface, excellent complex and current-news querying, and the most comprehensive collection of filters of any site, HotBot is once again our Editors' Choice for power searches. Graphical tools make it easy to construct complex Boolean queries and restrict searches by date, domain, media type, or other criteria.

The best directory on the Net, Yahoo! wins our Editors' Choice for the second year. Its categories are

expansive enough for broad topics yet specific enough for esoteric interests. Its staff-indexed database ensures high-quality returns.

Honorable-mention Infoseek, a solid choice if you want just one search site, offers useful pointers that direct you to news, directory links, and company information relevant to your queries. New entry Northern Light also earns high praise. Only its simple search was up and running during testing, but the success we had makes us eager for the site's completion.

Superior searching and ease of use earn Four11 our Editors' Choice. Four11 offers the richest search options of any people finder.

BigBook earns our Editors' Choice award for its vast database, excellent integration, and plentiful categories. You can search by name, category, or proximity to an address; the returns link to accurate mapping and directions.

For its consistency, useful search features, and deep archive, Deja News wins our Editors' Choice. You can set multiple filters, such as author, date, or newsgroup; search the current database or archives dating back two years; and search for newsgroups by category.

Editors' Choice winner ProFusion parses your query to fit the syntax of each site, ranks and integrates results, and can run searches for you. MetaCrawler earns our Editors' Choice for combining extreme ease of use with options to search Usenet, computer products, and shareware files.

Classifieds 2000 database, stocks, discussion groups, and shareware. Each section lets you pick display and filter options, such as sports news within NewsBot.

For Web searches, you can construct complex Boolean queries using a simple pull-down menu; limit searches by date, geographical area, and media type; and set the depth to which you want pages searched. HotBot also lets you search for domain names—that is, you

Our Contributors: DAVID LIDSKY is an associate editor of *PC Magazine*. NANCY SIRAPYAN is the librarian at *PC Magazine*. TREVOR A. DAWES is a library specialist, and NANCY E. FRIEDLAND, SUSAN MACICAK, and MICHAEL JOHN MILLER are librarians at Columbia University. BARB FALKINBURG is a librarian for Baltimore County Public Schools, Maryland. MELISSA J. PERENSON is a staff editor of and JENNIFER ANDERSON is an editorial researcher at *PC Magazine*. ALAN COHEN, JILL LÉGER, and EYAL RABINOVITCH are freelance writers. JAY MUNRO was the project leader, and REGINA KWON was the staff editor in charge of this story.

HotBot

QUICK TIP: Use Domain Name searching to find the URLs registered to a company.
www.hotbot.com

can type in a company name or part of a URL to get the actual link. The site supports natural-language queries,



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Each cartridge has a huge
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1-Step™ backup software protects
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Average seek time

10ms read/12ms write

Maximum sustained transfer rate

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†Assuming 2:1 compression ratio. Actual compression will vary with file and hardware configuration.

††Performance will vary when using 1GB cartridges.
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"How we fit one interstellar launch vehicle,
a few thousand flight hours, and reams
of highly sensitive information into a
4 INCH SQUARE."

STEVE JORDAHL

IS Analyst and Developer
McDonnell Douglas

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15.5ms read/17.5ms write

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10ms read/12ms write

Maximum sustained transfer rate

8.7MB/sec. max

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your Jaz drive to a Mac or PC,
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Internet Search Sites

and help is always available.

HotBot displays results with title, relevancy ranking, summary, and the date it was found. You can't jump back and forth among your results though, as you can in AltaVista and Lycos.

Though it does not try to be a destination site the way Excite and Yahoo! do, HotBot does offer several extras, such as business and people finders via BigYellow and Four11. You can also browse Wired's Cybrarian, a directory with such categories as media, reference, and technology, that direct you to high-quality sites. You can't search within categories, but the format, similar to Search.com's lists of links, is easy to use.—TAD

HotBot. Wired Digital, San Francisco.

Infoseek

A good all-around site if you just want one destination, Infoseek offers many useful extras, including e-mail news delivery, foreign-language searching, searching by geographical region, and personalized financial portfolios. We were especially pleased with Infoseek's current news searching, which accesses many top sources such as Businesswire, Reuters, CNN, *USA Today*, and the *New York Times*. If you need advanced searching or

are looking for exceptional extras, however, try HotBot or Yahoo!

On our tests, Infoseek performed well on simple keyword and phrase searches. We often found it worthwhile to refine queries, although Infoseek's unusual search syntax and lack of interface-based query building can be deterrents. You can search against InfoSeek's Web, Usenet, or news database.

Infoseek ranks results using several factors, including the frequency and location of query words within documents. Lists pointing you to related topics and news articles within Infoseek's directory accompany most returns. You may also receive Best Bets—links to home pages and

Hoover's capsule information for companies that may be relevant to your query. We found that Infoseek almost always provides useful information, whether in the index returns or in the related and Best Bets items. We look forward to Infoseek's plans for distributed database searching, which should improve return time and quality for geographical region searches.

Infoseek's directory focuses on mainstream topics, so if you have esoteric lean-



InfoSeek's Best Bets and Related hints often predicted what we were looking for in searching.

ings you may want to try Yahoo! instead. Infoseek earns points for letting you search within categories, something you can't do at Excite, but the organization could be improved: Education, for example, serves as a sort of catchall that includes history, environment, science, and reference sites.

If you want consistent index searching within a simple interface, Infoseek is definitely worth your time.—NS

Infoseek. Infoseek Corp., Sunnyvale, CA.

Suitability to Task



					
POWER	AltaVista	Excite	HotBot	Infoseek	LookSmart
Simple searches	Fair	Good	Good	Good	Good
Custom searches	Excellent	Fair	Good	Good	Fair
Directory searches	N/A*	Good	Good	Good	Good
Current news searches	Poor	Fair	Excellent	Excellent	Poor
Web content	N/A*	Excellent	Fair	Good	Fair
EASE	AltaVista	Excite	HotBot	Infoseek	LookSmart
Simple searches	Good	Excellent	Excellent	Excellent	Good
Custom searches	Fair	Good	Excellent	Good	Fair
Directory searches	N/A*	Fair	Excellent	Excellent	Good
Current news searches	Fair	Good	Excellent	Good	Fair
Web content	N/A*	Good	Good	Excellent	Good

N/A*—Not applicable: This site does not have this feature. N/A**—Not applicable: This feature was not available during testing.

Simple searches We rate the quality of returns after entering keywords and without using any customization options. The sites with the most relevant returns and fewest dead and duplicate links receive the highest power ratings. For ease, we consider the clarity of the presentation of results and the dynamic suggestion of keywords and specific sites through links or ads.

Custom searches For this task, we evaluate the tools provided for refining your search. The greater the effectiveness in improving returns over a simple search, the better the power rating.

We consider support for such options as Boolean AND/OR/NOT, proximity (NEAR), wildcards, keyword weighting, and exact-word and word-variant searching. The ability to narrow searches by domain, protocol, date, file type, and ranking criteria improves power. The availability of graphical tools to aid query building and ample, accessible help pages contributes to ease.

Directory searches Some sites offer browsable listings of topics. For power, we consider the breadth and depth of categories, the quality of sites and information, the ability to restrict searches within categories, and the quality of returns for searches. Advanced search options

Internet Search Sites

LookSmart

Designed for families, LookSmart offers a continually updated database of staff-reviewed sites within an intuitive pop-up directory structure. Though not geared for advanced or academic research, for everyday information needs this site is a reliable source of high-quality material.

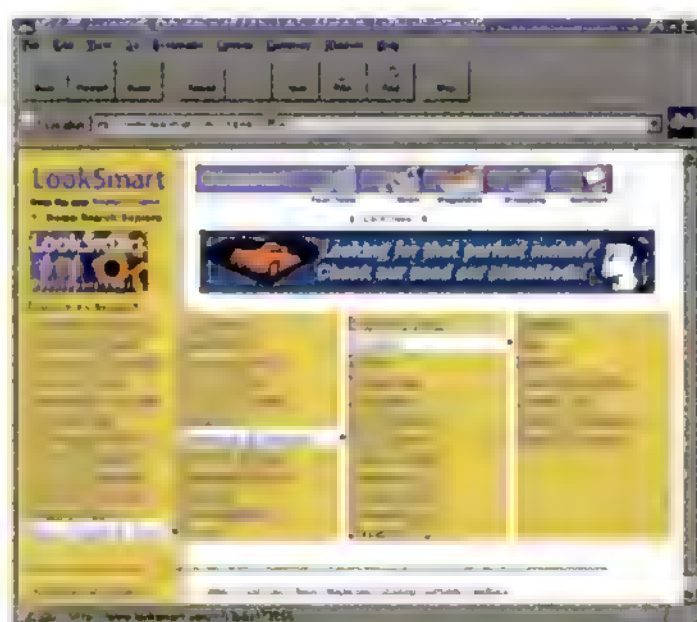
From the home page, you begin by selecting one of the categories, such as Business & Finance or Entertainment & Media, along the left-hand side. Subcategories display in columns across the screen, generally requiring three to four clicks before proffering a list of sites. Navigation is easy because the path you take is clearly marked, but the screen tends to become a little cluttered.

You can also conduct searches of the LookSmart database, although you can't search specifically within a category, as you can with Infoseek. If only a few returns can be found within LookSmart, the site automatically forwards the query to AltaVista as well. LookSmart matches always show up first, but there is no evidence of relevancy ranking for the AltaVista results. LookSmart does not let you conduct news searches per

se, but the site provides a comprehensive collection of news choices that covers both large, well-known sources, and smaller ones.

At the top of every page, LookSmart provides buttons to pages with links to top-flight news, magazine, shopping, and software sites. You can customize the sites on these pages via comprehensive lists, although you can't add any sites of your own. You can also create a regional page with sites that are local to the city you choose.—*Barb Falkinburg*

LookSmart. LookSmart Ltd., San Francisco.



LookSmart's drill-down categories always let you know what your options are.

Lycos

With numerous search options, a comprehensive directory, and good returns on simple searches, Lycos has excellent potential as a general search site. A cumbersome user interface and the frequent appearance of multiple links from a single site, however, reduce the usefulness of this service.

On our tests, Lycos performed well on simple searches, but we found little improvement when we customized queries. A pull-down menu lets you parse its database to search the Web, pictures, sounds, the Lycos-chosen TOP 5% of Web sites, or personal pages. The Lycos Pro search lets you require any or all of the words in your query and specify the display properties of your returns. Lycos Pro with Java Power Panel offers the most utility, letting you conduct Boolean, exact-phrase, and natural-language searches.

Using the Java Power Panel, you can also adjust the importance of various factors, such as matching every word, the frequency of words, and the location of the words in documents. Tweaking such attributes helped a bit, although symbols and stop words such as *the* still hindered searches, even on natural-



Lycos



Northern Light



Open Text Index



PlanetSearch



Search.com



WebCrawler



Yahool

Good	Excellent	Poor	Fair	Fair	Fair	Good
Fair	N/A**	Poor	Poor	Fair	Good	Fair
Good	N/A**	N/A*	Fair	Fair	Good	Excellent
Poor	Fair	Poor	Poor	Poor	Excellent	Excellent
Good	N/A**	Fair	Fair	Good	Good	Excellent
Fair	Excellent	Fair	Good	Fair	Good	Excellent
Good	N/A**	Poor	Poor	Good	Fair	Good
Fair	N/A**	N/A*	Poor	Good	Good	Excellent
Good	Fair	Fair	Poor	Good	Good	Excellent
Good	N/A**	Good	Fair	Good	Good	Excellent

improve this rating. Sites with the greatest accessibility and clarity for directories receive a high *ease* rating. Indication of where you are in the category structure also improves *ease*.

Current news searches For this task, we rate the tools available for searching current news. Fresh, relevant content, a broad range of high-quality sources, and elimination or consolidation of multiple similar links contribute to a high *power* rating. News-specific databases or customization options improve *power*. For *ease*, sites that provide good data with little or no customization receive the highest ratings. Other features that are also

important are clear presentation, with date, time, and source information, and the accessibility of the full text of articles.

Web content We consider additional content, such as chat rooms, bulletin boards, regional guides, news tickers, and people/business finders. We also look for customization, such as the ability to create a home page or receive e-mail information. The greater the variety and the higher the quality, the better the *power* rating. For *ease*, we consider the accessibility of such options. If a site requires downloads, plug-ins, or Java support, that decreases the *ease* rating.

language queries. Lycos ranks returns by percentage and, unlike Excite or Infoseek, lets you jump to any page in the results set.

Though comprehensive, Lycos's directory may confuse you with its inconsistent, often unwieldy interface. You must click through several screens before getting the option to travel directly to a site, for example, and some links automatically launch searches rather than keep you within the directory structure. And you can't search within a category, either.

Like Excite, Yahoo!, and others, Lycos offers a full spectrum of extra features, including regional guides, stock quotes, UPS tracking information, mapping, and white and yellow pages. —BF

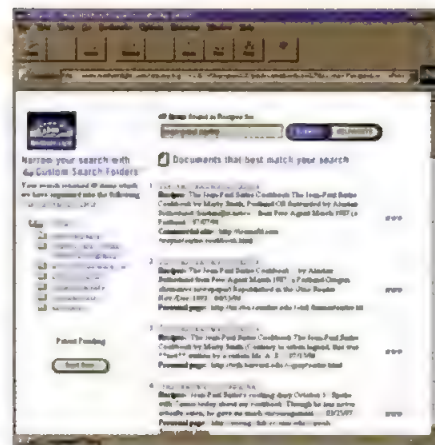
Lycos. Lycos Inc., Framingham, MA.

Northern Light

A newcomer to the Web-searching world, Northern Light is a well-organized, powerful tool that may incite mass defections from established sites. Because many advanced filtering options were not yet implemented at press time, this site is not yet comparable with leaders like HotBot or Yahoo!, but this is definitely a site to watch.

On our tests, Northern Light returned uncannily accurate hits on most searches. In addition to a returns list, you receive a set of extremely useful Custom Search Folders. Organized on the fly for each search, these folders group your returns by subject, type, source, and language—similar to the Best Bets of Excite and Infoseek but much more helpful.

With a few clicks, you can narrow thousands of hits to the few you really want. Northern Light was one of the best at weeding out both duplicate links and multiple, similar links from a single site—



Northern Light's Custom Search Folders helpfully organize search returns on the fly.

something Excite, Infoseek, and Lycos had trouble with.

Northern Light has contracted with premium content providers to provide a searchable Special Collection of specialty magazines and journals and says it offers

SUMMARY OF FEATURES

Search Indexes and Directories



■ YES ■ NO

Products listed in alphabetical order

	AltaVista	Excite	HotBot	Infoseek	LookSmart	Lycos	Northern Light
Web address	altavista.digital.com	www.excite.com	www.hotbot.com	www.infoseek.com	www.looksmart.com	www.lycos.com	www.nlssearch.com
Company	Digital Equipment Corp.	Excite Inc.	Wired Digital Inc.	Infoseek Corp.	LookSmart Ltd.	Lycos Inc.	Northern Light Technology LLC
Complex Searches							
Search using AND/OR	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Search using NOT/NEAR	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can set NEAR parameters	■	■	N/A	■	N/A	■	N/A
User-controlled wildcard	■	■	■	■	■	■	■
Engine supports truncated keywords	■	■	■	■	■	■	■
Supports nested (parenthetical) searches	■	■	■	■	■	■	■
Supports keyword weighting	■	■	■	■	■	■	■
Filter search by title/head/URL	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Search can specify Web/Usenet/FTP	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Narrow search by domain/domain class	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Narrow search by date	■	■	■	■	■	■	■
Results sorted by proprietary categories	■	■	■	■	■	■	■
Search by file type	■	■	■	■	■	■	■
Content							
News/weather headlines	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Sports/entertainment headlines	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Business news/Stock quotes	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Regional services	■	■	■	■	■	■	■
Web-site reviews	■	■	■	■	■	■	■
Listings of recommended sites	■	■	■	■	■	■	■
Child-oriented site	■	■	■	■	■	■	■
Customizable start page	■	■	■	■	■	■	■
Chat	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature.

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"If you use the Web a lot, and especially if you depend on a corporate intranet, Netscape Communications' newest offering could be the most important application on your computer."

Business Week, June 23, 1997

"Netscape's New Browser Is The Best One Yet."
Fortune, May 26, 1997

"The release of Netscape Communicator 4.0 ushers in an exciting new era for corporations, end users, and applications developers alike. Just as the advent of business productivity suites changed the face of the software market, so should Communicator (and soon, IE 4.0) change the way corporations do business both internally and externally."

PC Magazine, August 1997

"All in all, Navigator 4.0 is the best Web browser available today."

Wall Street Journal, July 10, 1997

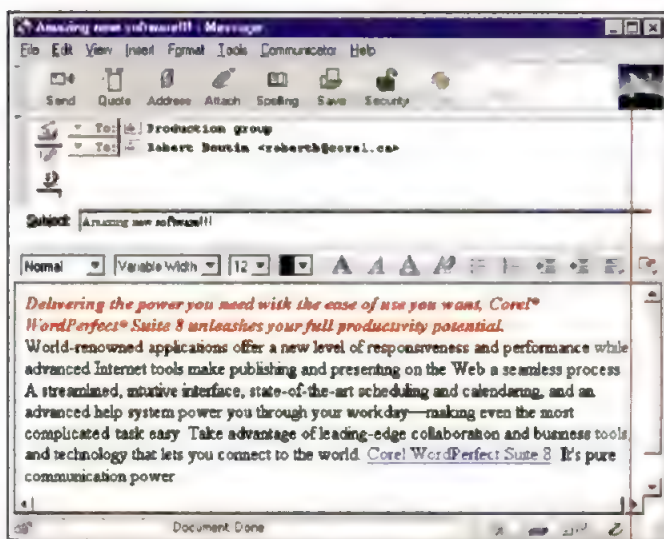
"Unlike Microsoft's Webcaster push technology, Netscape's Netcaster uses existing standards such as HTML, Java and JavaScript."

InfoWorld, June 2, 1997

"But there's further cause for celebration. For instance, Communicator 4.01 consumes about 3 MB of RAM less than Navigator 3.0."

C/Net, July 10, 1997

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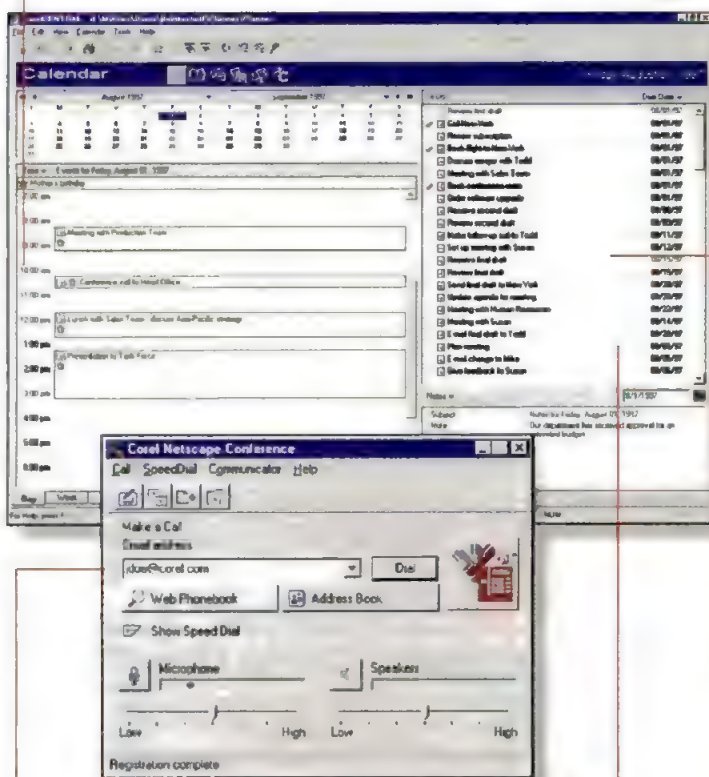
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you set up ongoing searches to run daily or weekly; PlanetSearch e-mails you the new URLs.—*Michael John Miller*
PlanetSearch. Philips Multimedia Center, Palo Alto, CA.

Search.com

Inviting design and ample help don't make up for Search.com's often uninspiring returns and frustrating interface.

On our tests, querying the Search.com directory returned far fewer and often less relevant results than Yahoo! The search engine, provided by Infoseek, lets you search using natural-language queries and keywords, and you can customize your search using Infoseek's unusual notation, which uses commas, hyphenation, and is case sensitive. Unfortunately, you have no graphical tools to help you build complex queries, although instructive examples are available via help.

You can browse categories such as

cess, you can personalize the links on PlanetSearch's front page, although you can't add links of your own. A truly useful feature lets you set up ongoing searches to run daily or weekly; PlanetSearch e-mails you the new URLs.—*Michael John Miller*
PlanetSearch. Philips Multimedia Center, Palo Alto, CA.

Entertainment, Health, and Travel by clicking through them or via an alphabetical list. You can also choose categories to search from a pull-down menu, but this represents a narrower list from the directory categories offered by the site. When you actually go to a category, you get a text box for searching a featured site, but you can't search the category itself, as you can in Infoseek and Yahoo! The categories themselves offer some helpful material, but simply cannot compete with the comprehensiveness of Yahoo!

You can also conduct Web searches using the Infoseek engine. A useful option lets you search your results, repeat searches within a category, or search using another search site, such as Alta-Vista or Excite, without reentering the search string.

Search.com performed extremely poorly when we tried it on national and local news searches. It fared better on international topics, although few hits were relevant to the current day's events.—*Nancy E. Friedland*

Search.com. CNET Inc., San Francisco.

Search.com

QUICK TIP: You can view all categories and subcategories alphabetically as well as in a directory.
www.search.com

WebCrawler

A simple search tool that offers solid results for novices, WebCrawler's most notable feature is its Web shortcuts.

When you search for a music-related topic, for example, WebCrawler also sends your query to Music Boulevard, then returns a special "shortcut" link with those hits in addition to your regular results. Other shortcuts link to relevant picks from WebCrawler's Guide of staff-reviewed sites, and many queries pull up links to Usenet searches via Deja News. While you cannot always anticipate when shortcuts will appear, we found that they represent the most fully implemented of the growing trend of adding commercial links to search returns.

WebCrawler performed respectably on simple searches, including with natural-language queries. The site supports complex Boolean operands but does not provide graphical tools. Such customizations frequently worked, but still, for complex or esoteric searches, you are usually better off consulting a more conceptually sensitive engine, such as Northern Light.

You can customize the presentation of results, including the level of detail displayed and the number of hits per page. WebCrawler gives you the useful option of

The Future of Search

These pages offer a good guide to searching, but it's apparent that such tools, no matter how advanced, still can't keep up with the Internet. The amount of data, the rapidity of change, and the hectic web of links pulling it together make truly coherent, comprehensive organization nearly impossible. People differ on where the problem lies—user interface, data collection and analysis, speed limitations of hardware, and so forth—but clearly, we need a new solution. Here is a sampling of new approaches from the information industry.

Mapping Companies such as *Perspecta* (www.perspecta.com) and *Semio Corp.* (www.semio.com) offer Java-based products that analyze and organize documents by concept and attribute. The products then respond to mouse- or text-based input with dynamically generated visual, navigable maps of relationships and hierarchies.

Collaborative Filtering *Alexa Internet's* (www.alexa.com) free downloadable toolbar stays on your desktop while you surf and provides statistics and owner information for the sites you visit. Using data on where other users who have visited a site have gone as well as link and text analyses of the site, Alexa dynamically suggests other links.

Specialization *NewsBot* (www.newsbot.com), from HotBot, is a standalone ActiveX control that you access from your desktop. You can search the NewsBot database of top news sites using an interface similar to a Web search screen.

Client-Side Metasearching Prompt Software's *WebSleuth* (www.promptsoftware.com) is another in the vast array of client-side search tools. WebSleuth lets you query an unlimited number of search sites simultaneously; the program analyzes returns and drops unrelated and broken links before giving you your results. **Personal Agents** *Inquisit* (www.inquisit.com) targets business professionals with a subscription-based "personal intelligence service." Users set up agents with ongoing queries; the agents monitor Inquisit's database of news and information services and send e-mail updates at times specified by the user.

Human Contribution Sites like LookSmart and Yahoo! use people to analyze and categorize the sites in their databases. *The Mining Company* (www.miningco.com) takes this a step further with its cooperative of sorts. Users apply to be Guides for subsites on specific topics. Guides are responsible for the focus of their sites and for updating links and adding new ones.

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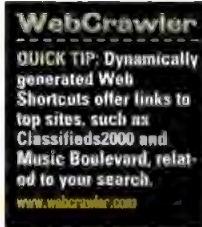


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having a "Next 10" button or links for page ranges. A link with each hit lets you search for "Similar Pages," the corollary of Excite's "More Like This" option.

WebCrawler uses a separate search technology from Excite, but unsurprisingly, its interface is similar to parent company Excite's Channel structure. WebCrawler's Channels, which cover general-interest topics, offer links to high-quality sites and chat rooms. With the exception of News, you can't restrict a search to a channel.

Current news searching on WebCrawler was a pleasant surprise. The accuracy and timeliness of the responses we received put Excite to shame.—*SM WebCrawler*. Excite Inc., Redwood City, CA.



Yahoo!



With a first-class Web directory, top-notch newsfeeds, and plenty of extras, Yahoo! is a great place to start looking for just about anything. AltaVista and HotBot may be more adept at searches for highly specific terms, but for the majority of your search needs, Yahoo! is an invaluable resource.

The site's real strength lies in its content and organization. With a wide range of topics and the ability to restrict searches within a category, Yahoo! is good for both casual browsing and serious research. Extensive cross-references between the various sections ease navigation, and we particularly like the ability to view complete directory structures in outline form.

On our tests, keyword searches for general terms yielded the best results. Since people index the sites in its database,

Yahoo! usually offers the highest-quality links of any site on such searches. Searches that get no results within Yahoo! automatically query AltaVista, which returns frequently helpful but unranked hits.



Searching for news in Yahoo! also conveniently finds related information within its directory.

LABS TESTS

Internet Search Sites

Weeks of testing these 36 sites reinforced some expectations—Yahoo! is still the best directory—and created new ones. Many sites provide unique customization options, but only a few provide truly useful returns.

How We Tested

Our script included general queries for evaluating how well each site handles various syntaxes and how well customizations work, and daily topical queries for evaluating the site's utility as a news source. We also tested the directories/categories offered by many of the sites for comprehensiveness, searchability, and ease of use.

The general queries included both single and multiple terms and used proper nouns, punctuation, and numerals. Terms were first entered as simple searches, then modified using each site's customizations. We examined the first ten returns of each search for the number of relevant hits, dead links, and duplicates. For the daily queries, we abstracted three searches from that day's top news and tested them both as simple searches and, if available, using news-specific databases or options. We examined results for correlation with the event in question, timeliness, quality and breadth of sources, and ease of accessing the full text. The results from these and the above tests are presented on this page.

We tested people finders by searching for acquaintances who had differing characteristics. Some had recently changed addresses and some

had not. Not all the people we looked for had e-mail accounts, and some of them that had e-mail had recently changed their e-mail addresses. For business finders, we ran queries covering a range of businesses throughout the U.S., targeting both recently opened and established stores. We tested the quality of category and business-name searching and ran proximity searches.

For Usenet search and metasearch sites, we ran the same general queries as for general search sites. We evaluated the depth, timeliness, and length of retention of each Usenet search site's archives, the organization, clarity, and accessibility of returns, the filtering options, and the ability to post messages and e-mail authors. We also ran queries to address the more obscure topics these sites cover. Metasearch sites were examined for flexible filtering options, accuracy in ranking returns, and the level of integration of hits from disparate engines.—*Jay Munro and Regina Kwon*

Query Tests: How They Fared

★★★★ Excellent ★★★ Good ★★ Fair ★ Poor

	Simple queries	Customized queries	News queries	Eliminates duplicates	Eliminates dead links
AltaVista	★★	★★★	★	★★★★	★★
Excite	★★★★	★★	★★	★★★★	★★
HotBot	★★★★	★★★★	★★★★	★★★★	★★
Infoseek	★★★★	★★★★	★★★★	★★★★	★★
LookSmart	★★★★	★★	★	★★★★	★★
Lycos	★★★★	★★	★	★★	★★
Northern Light	★★★★	N/A	★★	★★★★	★★★★
Open Text Index	★	★	★★	★★★★	★★
PlanetSearch	★	★	★	★	★★★★
Search.com	★★	★★	★	★★★★	★★
WebCrawler	★★	★★★★	★★★★	★★★★	★★★★
Yahoo!	★★★★	★★★★	★★★★	★★★★	★

N/A—Not applicable: This site does not offer this feature.

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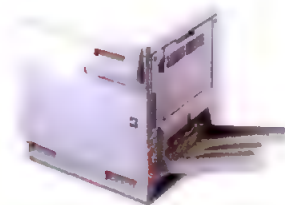


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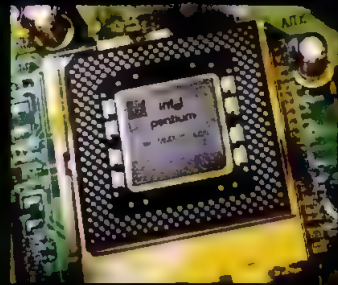
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Internet Search Sites

Fine-tuning queries with the graphical tools on the Search Options page did not help much.

Unlike other directory-only sites such as LookSmart and Search.com, Yahoo! performs admirably on current news searches; when you enter a topic from the day's headlines, the site returns great hits and a link to a page of related links and various news sources. Yahoo!'s wealth of extra features include customizable financial and start pages, chat rooms, a version of the site for kids called Yahoooligans!, listings of Web events, and a desktop news ticker. (Softbank, the parent company of *PC Magazine's* publisher, is an investor in Yahoo!)—NS
Yahoo! Yahoo! Inc., Santa Clara, CA.

Yahoo!

QUICK TIP: Use Yahoo! Remote to search via one browser window and display results in another.

www.yahoo.com

person's name (advanced searches let you specify a city and state, but then you must search for e-mail and white-pages data separately), returns often constitute very long lists. This applies especially to e-mail results: If Bigfoot doesn't find a perfect match, it ignores all but the first letter of the first name. If it doesn't find a match at that point, it ignores the first name altogether, which can lead to disconcerting results. A search for "John Doe," for example, may return results for "Aaron Doe" first.

Four11

www.four11.com



Our recommended people finder last year, Four11 wins our Editors' Choice, thanks to its superior searching capability, excellent integration, and user-friendly features.

SmartName searches pull up all variations of a given first name, returning "Dick" and "Rick" on a search for "Richard." Like WorldPages, Four11 can auto-

matically execute customized e-mail searches from a white-pages return screen.

Four11 is also the only site here that lets you search using just a first name, making it an excellent place to start if you're seeking someone with an unusual first name. When you search for an e-mail address, Four11 lets you search by domain, which is handy if you're hunting down people who work at a certain company.

As we went to press, Yahoo! Inc. acquired Four11. Yahoo! had been a front-end to some of Four11's people finder services, but you should expect to see a complete integration of Four11's features into the Yahoo! directory.

InfoSpace

www.infospace.com



Although it accompanies search returns with extra information that no one else offers, InfoSpace sometimes makes

it hard to find the data you want.

People Finders

BY JILL LÉGER

Wonder what happened to your old high school girlfriend? Lost that business contact's e-mail address? Look no further than Internet people finders—free, ad-supported sites that let you search for street addresses, phone numbers, and e-mail addresses, often by entering only a last name.

Most of the services here have comparable success rates for finding people, but we did detect evidence of marginally more comprehensive and up-to-date databases. Since these sites utilize similar if not identical databases (comprising publicly available data from white-pages resources, the Web, ISPs, and online services), they distinguish themselves by the way they search for information and their level of integration with mapping and launching e-mail searches from white-pages returns.

Bigfoot

www.bigfoot.com

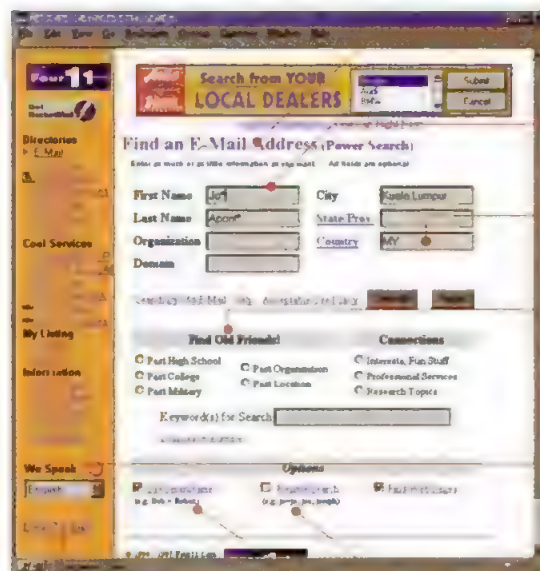


The only service that can search simultaneously for white-pages and e-mail data, Bigfoot is easy to use but doesn't always make information easy to access. Bigfoot's databases aren't integrated, so white-pages and e-mail hits comprise distinct lists.

Because initial searches require only a

Tips for People Finders

You should expect more from a people finder than a search box and a reasonably up-to-date database. Here, we take a look at the full-featured e-mail-search page of our Editors' Choice winner, Four11.



Missing: simultaneous white-pages search.

The interface supports wildcard searching.

The international search goes beyond Canada.

Find people with similar interests who have registered with Four11 or its free e-mail service, RocketMail.

Registering makes you easier to find, because you can enter information on personal interests and affiliations.

A consistent menu offers links to help, mapping, a free e-mail service, and more.

Avoid entering every variation of a name or incredibly truncated strings.

This option performs wildcard searches for you.

Internet Search Sites

White-pages returns come with a mass of related information. You can dial a phone number from the returns, access maps or directions, send a card, locate nearby businesses, or pull up a local city guide. We had good success finding people with InfoSpace, but the service returns only five hits at a time, so you could be clicking through screens for a while before finding the person you're seeking.

InfoSpace, like Switchboard, does not place wildcards after last names—unless you type in a last name only and not a first name. This means you must be fairly confident regarding a surname's correct spelling, since you can't type in, say, "Joe Sm" and pull up all the Joe Smiths and Joe Smythes—something all the other services here let you do.

Switchboard

www.switchboard.com



Switchboard.

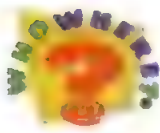
Switchboard lets members integrate their e-mail and street addresses and provides that information instantaneously to anyone conducting a simple search, making it a great site for finding Net-savvy people.

When it comes to searching for non-members, however, Switchboard's database disappoints. During our testing, it pulled up the fewest returns of any site here and twice failed to find information retrieved by all its competitors.

The service also has a problem with middle initials, considering those included in white-pages listings as part of a person's first name. Switchboard places a wildcard after a first name, so that a search on "Ron" for someone listed in the phone book as "Ron E." will pull up many "Ron" and "Ronald" listings before giving you your match.

WhoWhere?

www.whowhere.com



WhoWhere? stands out by giving you a welcome measure of control over what your search returns look like. At this site, if you want an exact match, you'll get one.

WhoWhere? is the only service here that doesn't place an automatic wildcard after a first initial or name in the first name or last name fields, letting you use

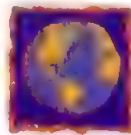
your own wildcards instead. This tactic is simplified during e-mail searching, when you can choose between "all matches" and "only exact matches."

But WhoWhere? lacks important features for white-pages searches. Users conducting e-mail searches can modify their criteria and launch new searches from the results page, and are informed of how many hits the service has retrieved. Those hunting down telephone listings, however, don't have these luxuries. And you can't do a custom e-mail search from your phone returns.

WhoWhere?'s e-mail listings suffer from poor integration. Returns do not come with any sort of city or state information—the kind of data that's essential to determine if you've got the right person.

Worldpages

www.worldpages.com



With some 230 directories representing 100 countries, Worldpages is the place to go if you're looking for someone who lives abroad.

But when you're searching the U.S., the service requires that you enter the state where your search target resides before it will retrieve any white-pages information, making it much less useful for finding old friends who may have moved. In addition, Worldpages is the only people finder here that is not LDAP-compatible.

Like Four11, Worldpages lets you conduct an e-mail search on domain names alone, and also offers a SmartName feature, pulling up all variations of a given first name. In addition, the service tells you exactly how many hits it has located and, like Bigfoot, calls up 20 hits per screen, making for faster searching of returns.

Business Finders

BY ALAN COHEN

The concept of online business finders offers significant advantages over traditional hard-copy books: You can find businesses all over the country without leaving your desk; proximity searches can zoom in on nearby establishments; business hours, and parking and payment information can be displayed along with addresses and phone numbers.

But these services are still very much works in progress. Clumsy interfaces and poor designs detract from the usefulness of some sites. Incomplete and sometimes inaccurate data mar others. We limited this roundup to six services that offer proximity searching—the "killer app" of business finders, making an exception for sites run by the regional Bell operating companies, as a point of comparison. After all, you most likely use their yellow pages, for now.

BigBook

www.bigbook.com



Intelligent organization, extensive help, and accurate information make BigBook your best bet for yellow-pages searching.

Of all the sites we saw, BigBook consistently returned the most comprehensive listings—though Switchboard came close. Within a specific 1-mile radius in Chicago, for example, BigBook returned 65 different bookstores, 4 more than Switchboard.

You can search directly from the home page, by category or business name, proximity, or by using any combination of category, name, area code, and ZIP code.

Readers' Picks



PC Magazine's online survey, which polled users on a list of sites representing the sections covered in this article, generated over 1,600 responses.

• **Search indexes and directories:** AltaVista and Yahoo! are the favorites. Of those who have tried them, 70 percent are fans, and many use the two in tandem. • **People finders:** 40 percent of respondents have tried Four11, and 76 percent of those like it. • **Business finders:** 22 percent have tried BigBook, and 64 percent are fans. • **Usenet search:** 29 percent have tried Deja News, and 79 percent of those like it. • **Metasearch:** Only 15 percent have tried MetaCrawler, but of those, 77 percent think it's great.

Visit us at www.pcmag.com for complete results.—Regina Kwon and Jennifer L. Anderson

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BI COASTAL



I work in two offices,

West and East Coast and I used to bring a lap top back and forth. The first one had the storage capacity of a walnut. The second one dropped off a table, and the third one got stolen at the airport. At three grand a pop it just wasn't working out.

So I got two **SyJet** portable drives from **SyQuest**. Now I just carry around a cartridge in my pocket, and best of all I don't spend my time in airports going, "Where's my bag?!" Whether you're commuting "Coast to Coast" or "Office to

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Internet Search Sites

The site's proximity searching lets users define a search radius (via a drop-down box) and results are listed by their distance from the source—a handy feature.

Results offer links to maps and, when applicable, store hours, reviews, ratings by BigBook users, coupons, and Web pages. For most listings, however, only the map is available. A toll-free customer-support telephone number is also available.

InfoSpace

www.infospace.com



Although its database is accurate and extensive, InfoSpace's haphazard organization and seemingly arbitrary categories not only hinder searching but also detract from the quality of returns.

For example, when we searched for tuxedo-rental shops within Boston, the site could not recognize either "tuxedo rental" or "formal wear" as categories. Instead, we had to search for men's clothing. Worse, the site returns proximity-search results in alphabetical order.

There are some nice features, though. For proximity searching, you can save a default starting address. You can also search for fax numbers, toll-free numbers, stock quotes, and regional weather.

Netscape Guide by Yahoo!

guide.netscape.com/guide/yellow_pages.html

N Foresight and innovation do not normally spring to mind when one thinks of a regional Bell operating company (RBOC). Unfortunately, these bare-bones Web sites won't do much to change that perception.

Rather than a consistent front end, Netscape's "guide," created by Yahoo!, merely provides links to the business finders operated by seven RBOCs. Although some offer a few nice features, poor integration, weak search capabilities, and odd results mar many of the sites.

For example, during a search for hotels in Seattle, U S WEST returned three listings, two of them duplicates and none actually in Seattle. Users looking for businesses in New York or New England will be disappointed in the BigYellow site, from Bell Atlantic, which lacks proximity searching.

One bright spot is At Hand, a combi-

nation business finder/regional guide from Pacific Bell. You can browse through a list of categories, search by ZIP or area code, and plot multiple listings on a single map.

Switchboard

www.switchboard.com



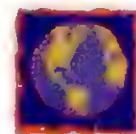
Switchboard. A slightly awkward interface keeps this otherwise excellent site from taking top honors. Like BigBook, Switchboard consistently returns accurate and comprehensive data. Proximity searches are particularly useful, listing businesses by distance from a specific address.

Switchboard offers numerous specific categories, so it's easy to find obscure types of businesses. But the drop-down box you choose from lists only major categories, and you must select more specific choices from a separate alphabetical list. You can also type in category names, but you must first learn the specific terminology yellow-pages databases use or you'll get spotty results.

Still, it's possible to find just about any type of business here. You can get toll-free phone numbers, and unlike WorldPages, Switchboard lets you modify queries.

Worldpages

www.worldpages.com



Helpful maps and a wide selection of categories do not make up for Worldpages' often inaccurate or incomplete results.

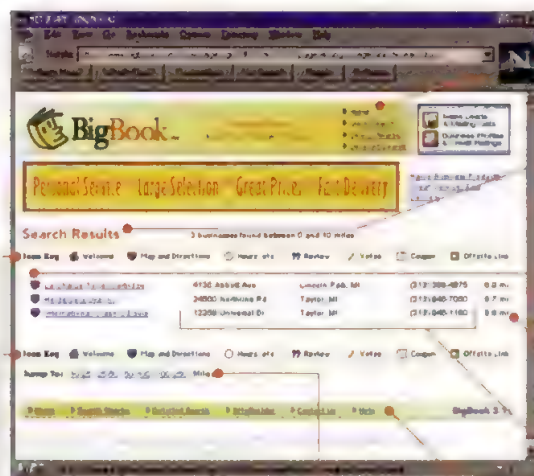
On a search for dry cleaners in San Francisco, for example, Worldpages found only 395 businesses, compared with BigBook's 529. Worldpages also suffers from numerous duplicate listings.

Normal search results are well organized and easy to read, but the site alphabetizes proximity-search returns, undermining the usefulness of such searches. And proximity searching frequently missed the closest business to a given location. The site also lacks an easy way to modify searches.

Tips for Business Finders



BigBook, our Editors' Choice winner, combines great features with a voluminous database. Here, the returns from a proximity search highlight the site's clean, well-organized interface.



Home is a click away.

Missing: any indication of what your current search is.

Maps, directions, and other information are hyperlinks.

Lists proximity search returns by distance.

Provides useful information immediately.

Well-placed keys tell you what you're viewing.

Handy links let you jump to different pages—organized alphabetically or, for proximity searches, by distance.

Help is always available.

Internet Search Sites

Zip2

www.zip2.com



The most aesthetically pleasing of the sites in this roundup, Zip2 offers a clean interface and ample, well-organized categories.

Unfortunately, the site suffers from frequent difficulties with proximity searching.

On normal searches, Zip2 responds with an accuracy and helpfulness that rivals BigBook's. But proximity searches turn up strange, sometimes completely inaccurate results. For example, when we tried to find the closest Mexican restaurant to a Manhattan address, Zip2 returned a business 2 miles away, reporting that it was just 0.2 miles from our starting point.

This flaw is a shame, considering all of Zip2's exceptional features. Categories are useful, deep, and cross-referenced—health clubs, for example, are listed under both Health and Sports. You can create and save default settings for multiple addresses, and you can easily search for other establishments near the businesses you find.

Usenet Search

BY MELISSA PERENSON

*News*group searching may seem a less than valuable concept, considering that postings rarely last longer than a week. But the archives kept by several services make it possible to track what users have said about your product or your favorite movie, for example, in the past year.

AltaVista, HotBot, Deja News, and Reference.COM offer proprietary Usenet searching. Other search sites offer Usenet searching, but using one of those engines. All of these Usenet search engines support basic Boolean operations and index the full text of the Usenet feed, although some cover more sites than others.

AltaVista

altavista.digital.com



Searching Usenet with AltaVista is a simple matter of choosing Usenet from a pull-down menu. Unfortunately, you don't get any Usenet-specific parameters to help narrow or organize results.

AltaVista's database, composed of 14,000 newsgroups, stretches back only

about four weeks. It's hard to determine the archive's timeliness because results appear in no discernible order. Returns show a post's date, subject, newsgroup, and the author's e-mail address, along with an icon that opens the post in a separate window. You can download binary files without opening their posts, but on our tests the files emerged garbled. Worse, AltaVista returns only a post's subject line—usually not enough to tell if a binary is attached.

Deja News

www.dejanews.com



No Usenet search site is perfect, but Deja News comes close, offering the best mix of filtering options and content. The site claims an archive of 20,000 newsgroups, indexed back to March 1995.

The clean interface provides continuous and easy access to all features, including posting to and browsing newsgroups. The Power Search lets you set keyword-match-

ing and database (current or old) preferences, as well as display and sorting options. Using the Search Filter, you can specify groups, authors, subjects, and dates.

From within an article you can go to the previous or next article, return to the results, view the thread, or post a message. Deja News offers unparalleled sorting: You can specify author, date, group, score, or subject.

HotBot

www.hotbot.com



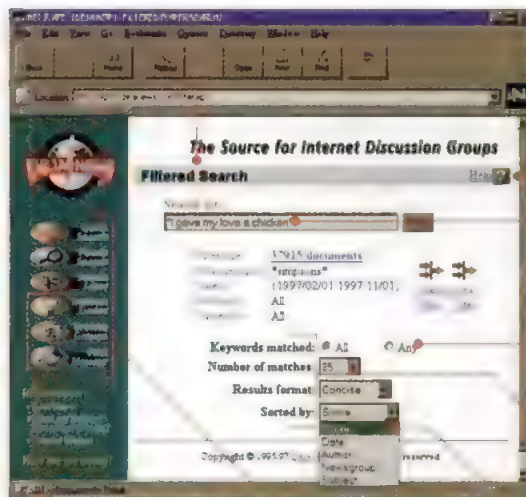
Newsgroup searches conducted with HotBot often provide useful returns, but the site simply lacks the scope and features of Deja News and Reference.COM. HotBot indexes about 20,000 newsgroups, and only retains messages for three weeks.

HotBot consistently returned fewer articles than Deja News and Reference.COM. A search for the mystery novel *The Nine Tailors*, for example, returned 7 hits in HotBot, compared with 19 in Deja News.

Tips for Usenet Search



For the wilds of Usenet news, the more filtering options the better. Editors' Choice winner Deja News offers great flexibility on your way to up-to-date, comprehensive results.



Setting a filter before searching helps narrow the results.

Help is always accessible.
Can handle punctuation.

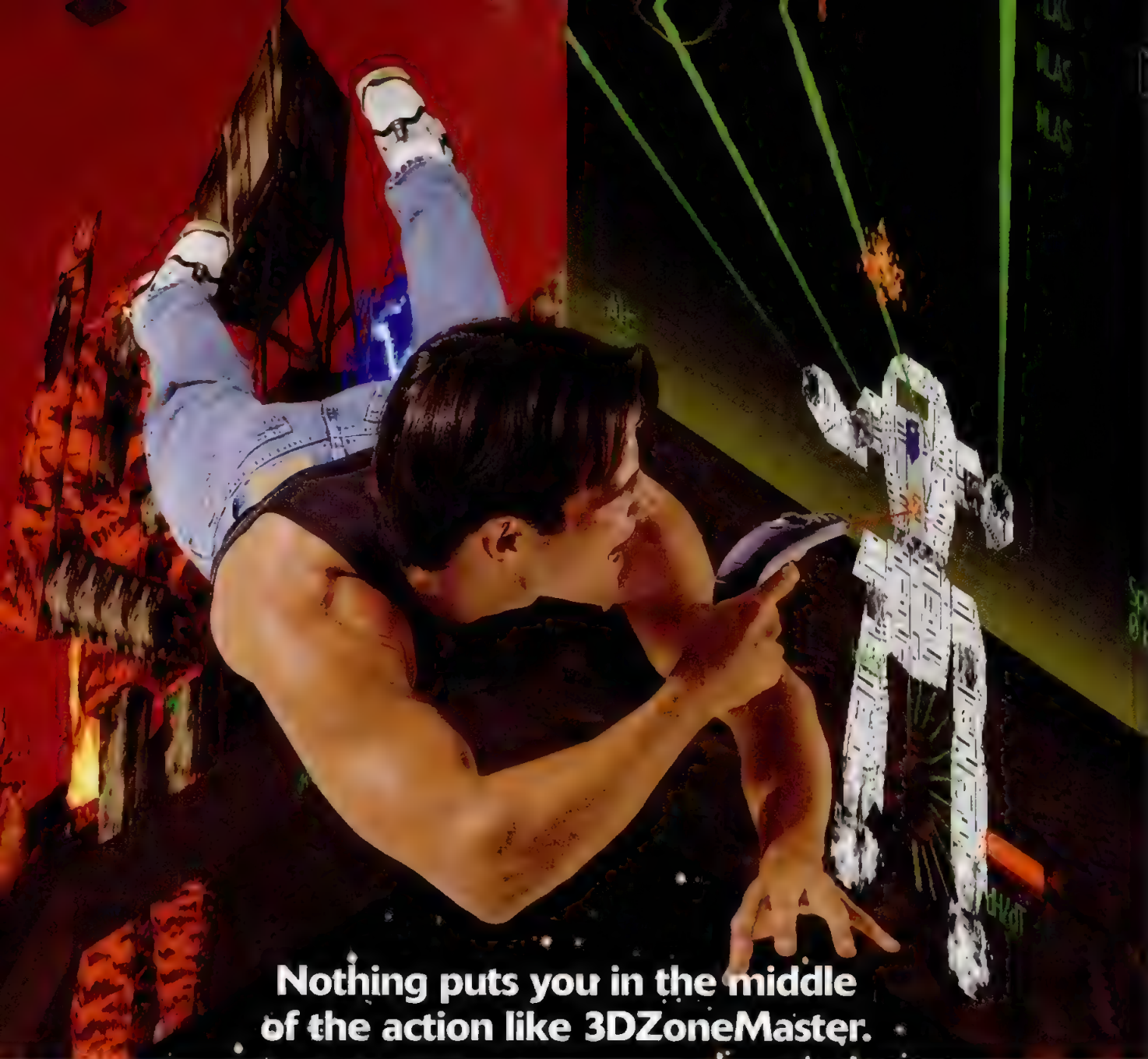
Missing: greater granularity of search options.

Lets you control how returns are displayed.

More ways to approach a newsgroup than straight searches.

An omnipresent menu lets you jump to any function you desire.

A ranking by score focuses returns.



Nothing puts you in the middle of the action like 3DZoneMaster.

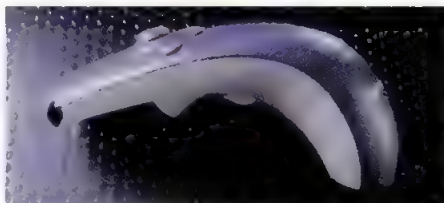


Still using an 80's-style joystick designed for flight-simulation games? Or even worse, a keyboard? Maybe that's why legions of butt-ugly mutants are

splattering your guts all over the galaxy before you advance even one level.

Don't crank-up the modem and start downloading game cheats. Just wrap your fist around Techmedia's 3DZoneMaster™ Ultrasonic Positioning Device and wield the power of this state-of-the-art 3D controller.

With 3DZoneMaster there are no wires and no clunky base. Nothing artificial to keep you from becoming immersed in the action. With its unique, patented ultrasonic tracking and ergonomic pistol-grip design, you move in three dimensions,



effortlessly, fluidly, instinctively—without hand or arm fatigue.

The 3DZoneMaster includes an array of programmable multi-function buttons to let you command all the firepower each game has to offer. And it's ready out of the box with Windows95™ drivers, Netscape Navigator™, exciting games and a host of predefined game sets.

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You would too, if you were an energy-saving monitor that could boast the lowest defect rates in the industry while performing brilliantly over the long haul of many of the supposedly reliable brands you may have found yourself attracted to but that in reality could never offer all those dollar-connected things you corporate types like to scrutinize including minuscule down time, virtually non-existent out of the box failures and brain-dead quick and easy set-up, a particularly invaluable feature often overlooked by many well-meaning but often evasive sale reps even though going without it means you'll be bogged down with unforeseen manpower costs not to mention that set-up problems just kind of take the fun out of buying a new monitor that may or may not share our monitor's complete compatibility with Windows 95 Plug and Play and Windows NT 4.0 or perform nearly as well as an award-winning EIZO, the company that also gives you as good a warranty and technical support package as you're apt to find anywhere. Geez. We could say a lot more but by now you surely get our point, so we'll wrap up by telling you that EIZO is the universal brand name of Nanao.

And that you can reach us at 800-800-5202 or on the world wide web at www.eizo.com. Reliably.

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ABOUT RELIABILITY.**



Internet Search Sites

In addition to such filters as Boolean and exact-phrase searches, you can specify a date and newsgroup. Results come ranked, and you can view articles in a separate window. HotBot doesn't display the author or date of posts in its list of results. You can't view threads or move from one article to another, and you can't post messages.

Reference.COM

www.reference.com



Though it claims a larger archive, Reference.COM is less successful than Deja News at offering targeted, comprehensive results. But as the only site dedicated to searching mailing lists as well as newsgroups, Reference.COM is a useful resource.

The site claims to index more than 45,000 newsgroups, and its database retains information only back to March 1997. The interface is logical but a bit cluttered. You must register before posting, but after doing so, you can have search returns sent to you daily via e-mail. You can also send queries via e-mail.

With the advanced search feature, you can filter by subject, author's name or e-mail address, newsgroup, and date. Although Reference.COM has options for sorting matches, they are not as useful as those in Deja News. From one message, you can navigate to the next or previous hit, e-mail the author, return to the hit list, post, or view the thread.

Metasearch

BY EYAL RABINOVITCH

As search sites try to become Internet destinations, metasearch sites continue to focus on ferreting out information from multiple search engines. We review eight metasearch sites that let you input your query once and then receive results from several engines. Top sites, like ProFusion, will format your words or phrases to fit the syntaxes accepted by each engine queried and will also integrate and rank the results.

In "Search Indexes and Directories," we review many of the engines queried by these metasearch sites. Our evaluations here concentrate on search-filter options, customizability of results, and the organization and clarity of the results. Other

important criteria include the quality and quantity of search sources, the speed of searches, and the overall simplicity and clarity of each site.

Ask Jeeves

www.askjeeves.com



The fastest and most creative—though not the most accurate—of the sites in this roundup, Ask Jeeves takes your natural-language queries and searches its own database as well as those of Alta Vista, Excite, Infoseek, Lycos, and WebCrawler.

On the assumption that people tend to look for similar things, the site's creators have built a vast knowledge base of typical questions and the links containing the answers. In addition to search engine returns, Ask Jeeves offers the questions from its database that most closely match your query. Although you may receive irrelevant returns, the results page will almost

always include directly useful sites as well.

Because Ask Jeeves sends your query as is, some engines produce useless results. Returns from the engines are cleverly organized into drop-down menus, letting you see all results on one page. But these menus include titles only.

Cyber 411

www.cyber411.com



Without any advanced search or customization options, Cyber411 is suitable only for beginners looking for an easy but unambitious introduction to metasearching.

A row of buttons at the top of your browser links to a directory of categories, such as news and business, a search form, and options for word or phrase searching and checking for duplicate results. Search results, which include only the title of each page, come quickly since the first engine to respond appears right away and the rest of the results page loads as returns come in.

Tips for Metasearch

Much of the power of a metasearch site—such as dynamically translating queries to fit the syntaxes of various engines—isn't visible from the front end. But certain features make a user's life easier. Here is the search page of Editors' Choice winner, ProFusion.



Missing: pull-down menus for constructing Boolean queries. You have to learn the syntax instead.

Consistent menu buttons for help and information.

Link checking notifies you of broken links but adds time to your search.

A granular search-engine selection.

A helpful hint cuts down on wasted query time.

Personal, ongoing searches help the advanced and academic researcher.

Graphical aids ease the filtering process.

A thoughtful option for users with older browsers.



Envision an enterprise that's

infinitely scalable,

totally expandable, completely compatible,

easily manageable, and entirely mobile.



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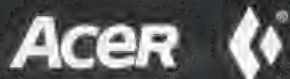
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AcerAltos servers have manageability built-in.



Because Cyber411 does not translate the search syntax for each of the 15 engines it queries, returns can quickly become irrelevant for even slightly complex searches.

With unsophisticated searching and unimpressive content, Cyber411 probably won't satisfy users with substantial search experience.

Dogpile

www.dogpile.com

DOGPILE Though it has an intelligent search process and an easy-to-use interface, Dogpile lacks the vertical extras and integrated search results of its closest analog, MetaCrawler.

From the home page, you enter your query and specify whether to search the Web, Usenet, FTP sites, or news sources. Dogpile's search plan is smart enough to translate even advanced operators and connectors to the syntax of each search site—only ProFusion does it better—but you can't control which engines are used.

Dogpile searches three sites at a time, beginning with the most directed, Yahoo!, and working up to the most broad, AltaVista, until it obtains at least ten results. Results appear grouped by search site, so you must often do a lot of scrolling before you find the most appropriate site.

Results come quickly and are usually on the money for general searches, but if you need a more complicated or targeted meta-search, you may want to look elsewhere.

Highway 61

www.highway61.com

HIGHWAY 61 You can expect quick, dependable results for simple metasearches from Highway 61, but confusing integration of returns and a lack of useful help information may block your way.

Using the options on the search page, you weight the depth of the results you want against the time it takes to get them. You can also set the amount of time the site should wait for each engine before timing out. These time-saving options may come at the cost of quality. You can also choose to include Yahoo! categories among your search sources.

Though well organized, the results page uses an odd ranking system that assigns confidence ratings per page of

returns, rather than for the returns for a query as a whole.

Mamma

www.mamma.com



A clear interface and good news sources can't outweigh Mamma's poor integration of returns and lack of advanced options.

You can search for phrases, get summaries of results, and search by titles of pages. Mamma translates Boolean terms into each site's syntax and, for phrase searches, drops sites that can't handle full phrase searching. Mamma also offers company and stock-quote searching.

You cannot manually choose search sites as you can in ProFusion and SavvySearch. Your returns don't have confidence rankings and don't indicate which search sites each came from—hiding the fact that Mamma orders returns by search site. Furthermore, since Mamma brings you only ten returns on each page, you may have to go back and forth through the list before you find the best result.

MetaCrawler

www.metacrawler.com



Superior clarity, depth, and organization make MetaCrawler the best site for simple or moderately complex searches. For advanced searches, however, you may want to try the more customizable ProFusion.

From MetaCrawler's default search page you can search the Web and send queries to Deja News, Filez.com, and ComputerESP. You can limit searches geographically by domain, extend or limit the number of returns you get on each results page, and set the number of returns from each source. Though MetaCrawler translates search operators only for sites that understand "any words," "all words," and "as a phrase" clauses, it integrates returns and ranks them en masse. This sophisticated system eliminates duplicates and ensures consistently high-quality returns.

With the extremely useful Ultimate Directory, you can conduct vertical Web searches within numerous categories, including yellow and white pages, classifieds, and corporate profiles.

ProFusion

www.designlab.ukans.edu/profusion/



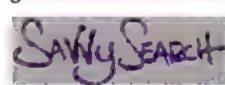
With an intelligent search strategy, helpful hints for targeting queries, and an invaluable personalized search service, ProFusion offers the best metasearching around.

The initial screen easily handles simple queries, and a host of options and customizations let you find even the most evasive Internet information. You can choose the best three sites for the structure of your search or the three currently responding the fastest. You can also search all of the nine sites offered or select them manually. ProFusion parses queries for each site's syntax; for true Boolean queries, you choose "Boolean" from a pull-down menu. ProFusion integrates and ranks returns, but, unfortunately, doesn't display which site each return came from.

Best of all is the personalized results page. After a free registration, ProFusion maintains a page for you that reruns queries weekly or monthly and e-mails you when changes have occurred.

SavvySearch

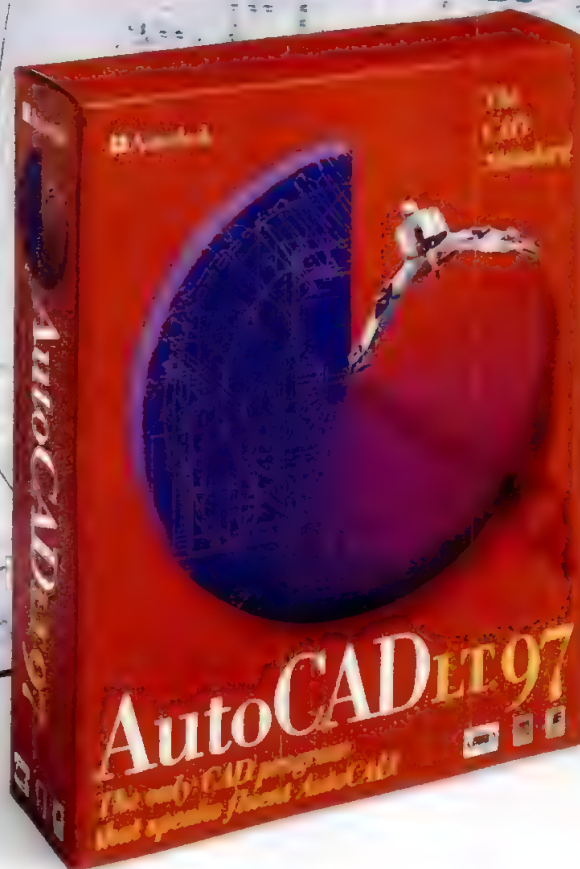
guaraldi.cs.colostate.edu:2000/form



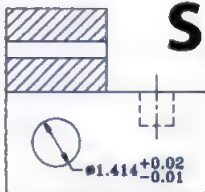
With excellent customization options and support for even the most complex of searches, SavvySearch is a great site. The lack of such valuable extras as the ability to conduct ongoing searches, however, makes it less ideal than ProFusion.

You can customize how many returns the site pulls from each engine, whether they are integrated, and the level of detail of the returns. SavvySearch attempts to locate dynamically the engines that best fit your query structure and are not currently bogged down, so that the results will come back to you as quickly as possible. You can also choose to have SavvySearch integrate the results from various engines.

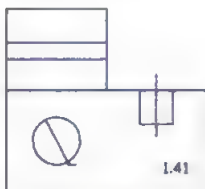
The default interface is fairly straightforward, but SavvySearch could benefit from greater integration. Some useful search options are initially hidden, and you must click on an easily missed link to get to the new "experimental" interface that offers categorized groups of index and search sites as well as the usual search options. **PC**



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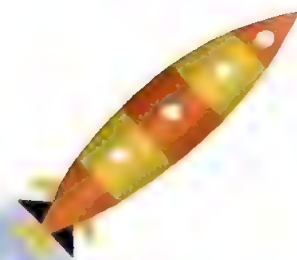
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GRAPHICS ACCELERATORS

New Technology New SPEED



By Jeff Mace

AGP and new graphics chip sets bring faster rendering to the PC. We test 32 affordable accelerators.

AGP, D3D, 3-D graphics. These buzzwords have been players in the graphics arena for two years, but most PC users haven't seen what the technologies can do for them. That will change in the coming year.

Microsoft's Direct 3D (D3D) standard, which lets developers use hardware-rendering assistance to deliver applications that simulate three-dimensional worlds and images, will become more widely adopted and supported. This means that 3-D graphics will finally move beyond games and start appearing in applications for business users—browsers, presentation packages,

and data-mining tools. In fact, nearly every new graphics board on a store's shelf or in a new PC today is 3-D-ready and just waiting for the applications to catch up.

We've also tested the first crop of graphics accelerators that take advantage of Intel's AGP (Accelerated Graphics Port) architecture, instead of the PCI-bus accelerators now in use. When implemented well by the graphics-board manufacturer, AGP improves 3-D graphics performance.

The short version: If you are buying a graphics accelerator, insist on good 3-D performance. If you're getting a new PC, consider one with AGP.

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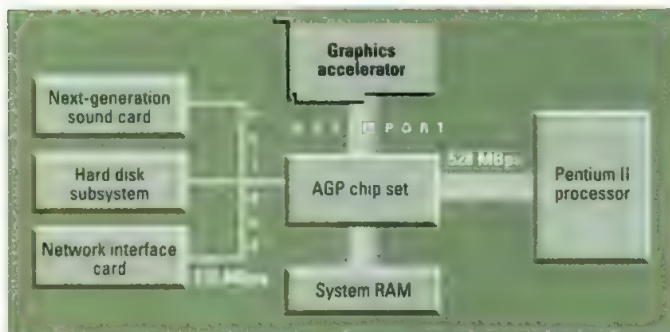
REVIEW CRITERIA

For this review, PC Labs tested PCI and AGP graphics accelerators that were new to the market since our previous roundup ("3-D Showdown," June 24, 1997). To be included, a board had to accelerate both 2-D and 3-D graphics under Windows 95 and deliver at least 1,024-by-768 resolution at 24-bit color depth (with a vertical refresh rate of 75 Hz or better) and 1,280-by-1,024 at 16-bit color depth (at 60 Hz or

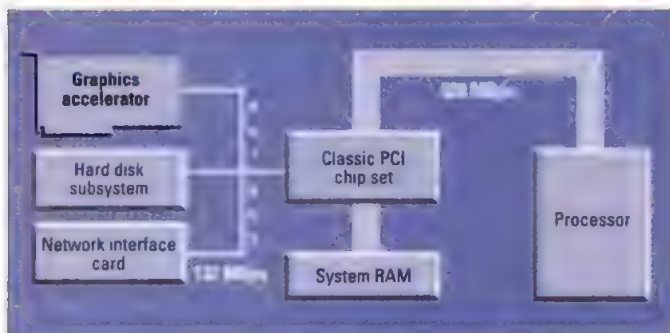
New Speed, New Uses for 3-D: AGP and improved graphics chip sets are boosting

AGP adds a dedicated bus for the graphics subsystem, because...

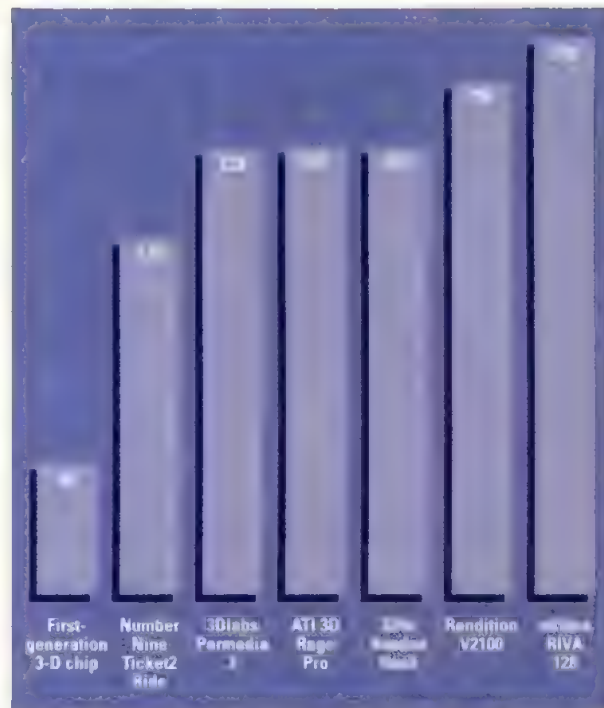
In addition, new chip sets speed 3-D rendering...



...PCI's bandwidth was limited for texture-intensive 3-D rendering.



AGP (Accelerated Graphics Port) provides a high-speed pipeline between the graphics accelerator and the PC's system memory. The graphics card gains access to system RAM to store and execute texture bitmaps, which allows more detailed textures of unlimited size while speeding 3-D rendering. AGP also helps speed the flow of decoded video from the CPU to the graphics controller.



Our 3D Graphics WinMark scores show a dramatic jump in 3-D rendering speeds from the current crop of accelerators versus those we tested just six months ago. The leaders are boards based on the nVidia RIVA 128 chip, followed closely by those that employ the Rendition V2100, ATI 3D Rage Pro, 3dfx Voodoo Rush, and 3Dlabs Permedia 2.

better). The boards had to have at least 4MB of RAM and be priced at \$300 or less on the street.

These criteria netted us 22 PCI and 10 AGP boards ranging in price from \$100 to \$300. The steep drop in memory prices over the past 24 months has meant that a wide variety of cards now fit under our price cap:

- Budget-priced models (\$100 to \$120) that deliver good 2-D Windows acceleration but only marginal 3-D acceleration.
- Midpriced cards (\$130 to \$250) aimed at Windows 95 business users, gamers, or both. This is the sweet spot of the market. These models generally deliver impressive 2-D performance at mainstream resolutions (800-by-600, 1,024-by-768) and very

good or outstanding 3-D. They often have extras, such as TV-out functionality, handy display utilities, and generous software bundles (usually including 3-D games).

• More expensive cards (up to \$300) that can deliver good acceleration at higher resolutions (1,280-by-1,024, 1,600-by-1,200) and color depths (24-bit, 32-bit). These boards are suitable for power users or graphics and CAD professionals (often working under Windows NT) looking for a low-end graphics workstation.

The heart of all of these graphics accelerators is the graphics chip, which executes the calculations that make 2-D and 3-D graphics possible. There has been an explosion in the number of chips available to board makers, and the units we tested

employed nine different ones: ATI Technologies' Rage Pro (on three boards in this review), Matrox's MGA-2164W (one board), the PCX2 from NEC and VideoLogic (one), Number Nine's Ticket2 Ride (one), nVidia's RIVA 128 (four), Rendition's Verite V2100 (one), S3's ViRGE family (two), the Voodoo Rush from 3dfx (four), and 3Dlabs' Permedia 2 (six). Four more chips were ready on sample boards from the chip makers and in some PCs, though not yet for sale: the Warp5 from Oak Technologies, Rendition's Verite 2200, the ViRGE GX/2 from S3, and Trident Micro Systems' Blaze 3D Ultimate.

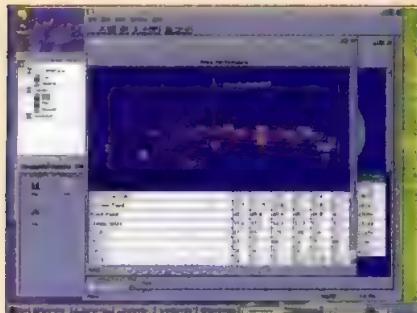
PERFORMANCE EVALUATIONS

When buying a graphics accelerator, one of the most important things to consider is 2-D performance. An accelerator's function is to render everything you see on the screen, and to do it fast. In a traditional 2-D Windows GUI, the card's performance (along with your CPU) determines

Our Contributors: JEFF MACE is a project leader for PC Labs. JAN OZER is a contributing editor of *PC Magazine*. JON HILL and JAMES KARNEY are frequent contributors to the magazine. ROB GLIDDEN is a senior contributing editor of *Wave*, a newsletter that covers 3-D and media technologies. DAVE MOREY is a chief architect at ZD Benchmark Operation. JAMIE M. BSALES was the associate editor in charge of this story.

3-D rendering on the PC by leaps and bounds.

...which will make 3-D applications and games more inviting to use.



This data visualization tool from Intervista (code-named Amber) lets you import spreadsheet data and generate a 3-D landscape of data that is easier to digest at a glance than endless columns of numbers



The Web also will deliver more 3-D content. Look for 3-D home worlds—virtual malls, model houses, and places of interest that you can navigate through, such as Fulton County Stadium

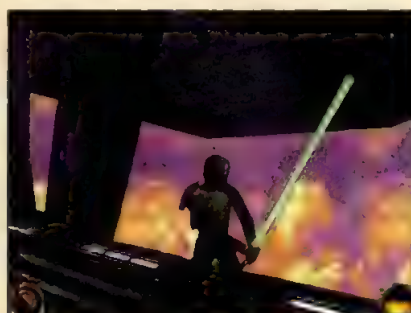
how quickly menus and dialog boxes appear and how fast the screen is redrawn when you scroll or toggle from one application to another.

Among the boards we tested, 2-D performance at the resolution and color depth in which a typical business or home user works (1,024-by-768, at 16-bit color) was generally very good. You would be hard-pressed to see differences in real-world use from one card to the next. So mainstream users can base their buying decisions on other factors (3-D performance, features, and price).

We saw greater 2-D performance differences at higher resolutions and color depths, especially under Windows NT. If you use a large-screen monitor (19- or 21-inch) or think you might upgrade to one down the road, pay close attention to an accelerator's ZD Business Winstone 98 and ZD Business WinMark 98 performance (presented in our Performance Tests sidebar).



Presentation packages will also take advantage of 3-D rendering techniques. This bar graph, created with Caligari's trueSpace, employs transparency and advanced lighting effects for greater visual appeal



Games will continue to push the envelope of 3-D rendering. Detailed textures, lighting effects, and a true sense of depth make games like Jedi Knight: Dark Forces II, from LucasArts Entertainment, more thrilling

Also, inexpensive mainstream boards do not have the horsepower or the driver support to run high-end graphics applications such as AutoCAD and Microstation. Users of these applications need to look to the handful of boards in this review able to meet those demands: AccelGraphics' AccelStar II (\$280 street), the Diamond FireGL 1000 Pro (\$230 street), ELSA's Winner 2000/Office (\$270 street), the Matrox Millennium II (\$300 street), and Number Nine's Revolution 3D (\$240 street).

But for those mainstream-business or home PC users who are buying today with an eye towards the future, 3-D performance is a better differentiating factor. Like a game of leapfrog, advances in speed for cards in the nascent 3-D arena are coming one after the other. The new chip sets

in this review more than triple the 3-D acceleration we saw from the previous generation of chips just six months ago. The best 3-D performers in this roundup are the Canopus Total 3D 128 V (\$230 street), Diamond Viper V330 (\$180 street), and STB Velocity 128 (\$200 street)—all of which use the nVidia RIVA 128 chip.

In 3-D games and applications, performance is critical. Games gave mainstream 3-D acceleration its start, and game developers have been adding a sense of realistic depth to their creations for years. In the games available today, players feel as if they are looking down a hallway or surveying a landscape instead of watching a flat screen. The addition of a z-axis in rendering, as opposed to simply drawing on an x, y-coordinate plane, requires a lot of sophisticated horsepower. In addition, the new breed of games contain more complex objects and complex textures: bitmap renderings of detailed surfaces (bricks, sand, or transparent water) that heighten realism. To deliver all this and maintain a good frame rate—preferably close to the 30 frames per second of motion video—hardware-assisted acceleration is a must.

APIs (application programming interfaces), such as those within Microsoft's DirectX Foundation and proprietary schemes from graphics-chip makers, let developers get directly to the display hardware to increase speed. For their part, the graphics chips and APIs support a wide range of special effects that developers can call on: fog at varying densities; transparency, to make glass objects or

water more realistic; specular highlighting, which gives the illusion of light reflected off a surface; lights that resemble spotlights or floodlights that originate from a source and can move with an object; and many more.

www.pcmag.com
Which of these graphics accelerators fits your speed and feature needs? See our interactive benchmark tests and Summary of Features table to find the product for you.

3-D: MOVING BEYOND GAMES

While gamers have been reaping the benefits of all this technology, 3-D applications have taken a while to filter through to mainstream business PC users. We're still waiting for the killer application that will make 3-D support a must on every business and home PC. But as the installed base of 3-D-capable PCs reach-

Editors' Choice

- Business: STB Velocity 128, Number Nine Revolution 3D
- Home: ATI All-In-Wonder Pro



Now is a great time to be buying a graphics card: There are good choices at every price level for home, office, and power users.

Mainstream business buyers should look closely at our first Editors' Choice, the Velocity 128 from STB Systems (\$200 street). Based on the nVidia RIVA 128 chip (currently the fastest 3-D engine on the market), the card delivers good 2-D acceleration at the resolutions and color depths that typical office chores require, and 3-D acceleration for the titles is among the best available today. STB includes a good software bundle, including a VRML browser for visiting 3-D Web sites, Micrografx's Simply 3D for creating 3-D objects, and three 3-D games.

Power users and graphics professionals who need a more robust, extensible accelerator will do well with our second Editors' Choice: Number Nine's Revolution 3D (\$240 street for the 4MB version we tested, \$300 for the 8MB model). Based on Number Nine's own Ticket2Ride chip, the card delivers stellar 2-D acceleration at mainstream business resolutions and color depths. For Windows NT users, the board delivers solid performance, especially at higher resolutions and color depths. 3-D performance did not match that of the new gaming-oriented boards, but is still fine for most business users.

If you are looking for a graphics card for your home machine, look no further than our third Editors' Choice, the All-In-Wonder Pro from ATI Technologies (\$280 street for the 8MB version). The

previous iteration of this card (the All-In-Wonder) was an Editors' Choice in our graphics-accelerator roundup six months ago, and we like the new version even better. ATI includes every conceivable graphics function: excellent 2-D and 3-D performance from the company's new Rage Pro chip set, TV-out for displaying PC images on your TV, video input for a VCR or other

source, a built-in TV tuner for

watching television—plus

a handy utility that captures closed-caption strings to a searchable text file, and a clever "instant replay" function that stores and replays the previous 10 seconds of video.

Eight other cards merit an honorable mention. ATI

offers Xpert @Work (\$220 street for the 8MB version) and Xpert @Play (\$240 street) for users who want the performance of the All-In-Wonder Pro but don't need all the extras. The Viper V330 from Diamond (\$180 street) and Dynamite 3D/GL (\$280 street) are fine all-around performers; the former unit for office or home users and the latter for power users. Windows NT users should look at AccelGraphics' Accel-Star II (\$280 street), Diamond FireGL 1000 (\$270 street), and Matrox Millennium II (\$300 street), all of which performed very well on our high-end Windows NT tests. For budget-constrained users, STB's Nitro 3D (\$100 street) delivers good 2-D speed, passable 3-D, and ease of use at a bargain price.



es critical mass, software developers will start to fill that void.

Pioneers in 3-D productivity applications will likely be software vendors clamoring for recognition among their competitors. The DirectX Media Layer component of Microsoft's DirectX 5a API will make this relatively easy to do. One of its services, Direct3D retained mode, will enable programmers not familiar with 3-D coding to incorporate 3-D objects that move within a 3-D world space, or sit atop a regular 2-D interface. An object like this may be useful in a floating palette of tools, a tutorial, or a wizard that extends the application.

Look for more advanced uses of 3-D in presentation packages, where its visual impact will make for a more powerful and engaging presentation. Just as interesting are data-visualization and data-mining tools that may help to make business professionals more productive. Three-dimensional spreadsheets could turn endless columns of numbers into 3-D maps of the country, with sales figures creating mountains or valleys as appropriate, once the numerical data is converted to the 3-D chart form. Correlation of small data sets and their relation to the big picture may become more apparent and not get overlooked.

For training and education, workaday PCs will be able to render machine parts and other complex 3-D objects that formerly could only be drawn on expensive graphics workstations. Students could virtually explore faraway places, or walk around a lifelike model of a tyrannosaurus in a museum. Or potential home buyers could evaluate a real-estate layout on-screen in a convincing 3-D world.

But the most prominent delivery vehicle for 3-D content could be the Web. VRML (Virtual Reality Markup Language) 2.0, the programming standard for 3-D on the Web, enables users to log on to 3-D sites and interact within a 3-D world. Log onto a site, click on an object, and it comes to life; turn it, move it, do what you can't do with a flat image. 3-D interaction could be helpful for everything from shopping to learning about physics on the Web.

There are VRML authoring tools available from several different vendors, and both Microsoft Internet Explorer 4 and Netscape Communicator include VRML

Graphics Accelerators

2.0 browsers. While DirectX support in Windows will enable all users to reap these 3-D benefits via software emulation, users with graphics accelerators able to speed the process along will have a better experience.

DO I NEED AGP?

The short answer is yes. Over the next few years, more and more 3-D applications will be chock-full of multiple objects and use larger, photo-realistic textures. The idea of a separate graphics port to assist the 3-D-processing pipeline is not new—Silicon Graphics has long offered systems that can be configured with up to 16 graphics ports for fully immersive virtual-reality rendering—but it is a very welcome solution in the PC space.

The accelerated graphics port is a high-speed, point-to-point connection between the system chip set and the graphics chip. Using an AGP connection, a graphics chip is able to access system memory directly through the system chip set at memory-bus speeds, reducing latency and substantially increasing performance versus standard PCI-memory transfers. Note that your system's chip set must include support for AGP transactions, and the graphics chip must be built to communicate to the system chip set via AGP protocols, so you won't be able to upgrade your PC to AGP unless you buy a new motherboard. When textures are large, AGP can make the difference between a smooth or choppy frame rate in 3-D rendering.

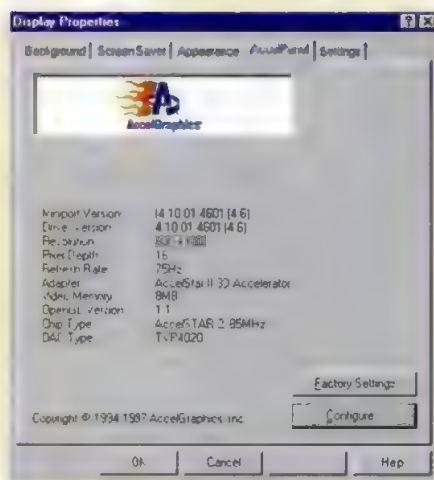
Ten of the boards in this review are offered in both PCI and AGP versions. Since AGP is a system solution, don't look for AGP cards at your local computer store (at least not yet). A bit of time will pass before AGP is considered mandatory (although most new Pentium II systems with the 440LX chip set have AGP capability built in). As more richly textured applications begin to arrive, look for AGP to gain in popularity.

OTHER CONSIDERATIONS

Once you've established which accelerators have the right mix of 2-D and 3-D performance for your needs, you can start to consider the extras most card makers are building into their products. One welcome feature, which ATI pioneered a year ago, was the inclusion of a VGA-to-NTSC converter right on the card. This

feature lets you display computer data on a standard television without the need for an external scan converter (usually \$100 or more). Business users can then give PC-based presentations with TVs as large-screen monitors, and home users can play computer games on their TV sets. Twelve of the cards we reviewed include this feature standard or as an option. Six of the cards also offer support for video input, so you can use the card for videoconferencing or video capture.

Many boards also contain a feature connector for attaching daughtercards for



AccelGraphics' AccelPanel lets you see the card's settings and change parameters easily.

specialized uses. Six of the vendors sell a TV-tuner card (\$80 to \$130) that lets you watch television in a window on your PC, and the ATI All-In-Wonder Pro (\$280 street) includes a TV tuner as standard equipment. Matrox has introduced a whole line of add-ins, the Rainbow Runner series, that let the company's customers add video-editing capabilities and more.

You should also consider whether you'll ever want to upgrade your card to more memory down the line. Eight of the boards in this review come with 4MB of RAM and cannot be upgraded, which limits the resolution and color depths you can run. Most cards let you add up to 8MB of RAM, and the ELSA GLoria Synergy, Matrox Millennium II, and Number Nine Revolution 3D let you add up to 16MB. If you're planning to upgrade to a 19- or 21-inch monitor sometime soon, be sure to get a card you can upgrade and so protect your investment.

The graphics card landscape is evol-

ving quickly, and the cards available today take good advantage of the advancements being made. The reviews that follow should help you narrow your choice from a strong field of contenders.

AccelGraphics AccelStar II

3Dlabs Permedia 2 chip, 8MB SGRAM, 1,600-by-1,200 resolution at 75-Hz refresh. Street price: PCI and AGP, \$280.

A 3-D powerhouse under Windows NT, the AccelStar II from AccelGraphics should be considered by high-end PC and workstation users as well as by mainstream users of large-screen monitors who need a well-priced 8MB board.

Setup of the PCI version of the AccelStar under Windows NT 4.0 was straightforward, and the card ran all of our applications without difficulty. High-end software support includes drivers for OpenGL, AutoCAD, Microstation, and Heidi, but don't expect any after-hours goodies: There are no extras in the software bundle.

The AccelPanel user interface, embedded into the Windows 95 Display Manager, includes several helpful features that make life a lot easier. The interface shows the board's configuration, drivers, firmware version, and current settings. If you choose the Configure option, you can tune OpenGL and Direct3D parameters such as perspective correction modes, buffer settings, and texture pixel depths.

Performance on our 2-D benchmark test suite was exceptional. The AccelStar II, in both its PCI and AGP configurations, was a top-tier finisher on our ZD Business Winstone 98 tests, and raw scores on our ZD Business Graphics WinMark tests were also very good. The Permedia 2 chip also was a strong contender on our ZD 3D Graphics WinMark 98 tests. In subjective evaluation of the on-screen 3-D effects, transparency was very good, and the card's dithering ability was excellent.

Because of its high-end aspirations, the AccelStar II was one of six cards in this roundup that we also tested under Windows NT. The card was the top performer at 1,024-by-768 resolution (and 24-bit color) on our ZD High-End Winstone 98 test, and was in the running at higher resolutions as well.

If you're looking for a solid Windows NT accelerator with 3-D capabilities to boot, the AccelStar II should be on your



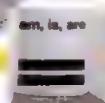
Christian Murphy was non-verbal. He lived with a wall between himself and the world.

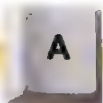


1

THIS IS CHRISTIAN.

He can see, hear, feel, touch, but he cannot speak. He was born with autistic tendencies that cut him off from the world around him





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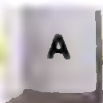
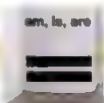
	Max Res	Bandwidth	CRT Type	Pitch
A500	1280 x 1024 @ 60Hz	112MHz	Dot Trio	0.28mm dot
A700	1280 x 1024 @ 65Hz	119MHz	Dot Trio	0.28mm dot
E500	1280 x 1024 @ 65Hz	119MHz	CROMACLEAR	0.25mm mask
E700	1600 x 1200 @ 65Hz	177MHz	CROMACLEAR	0.25mm mask
E1100	1600 x 1200 @ 65Hz	177MHz	Dot Trio	0.28mm dot



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BENCHMARK TESTS

Graphics Accelerators



Although 2-D performance has leveled off in the past year at mainstream resolutions and color depths, 3-D rendering speeds continue to improve by leaps and bounds as new chip sets arrive.

What the Numbers Mean

Winstone 98 On our ZD Business Graphics Winstone 98 tests, at the resolutions used most by the typical business or home user (1,024-by-768 resolution with 16-bit color), it's fair to say that most of the cards tied for first place. Scores for 20 of the cards fell within 6 percent of one another. The exceptions were the BioStar Venus 3D Rush, Intergraph Intense 3D Voodoo, and Jazz Adrenaline Rush 3D. These models were plagued by poorly optimized drivers and the relatively slow Alliance ProMotion controller. Still, even these cards' 2-D acceleration should be fine for typical office chores.

At 24-bit color depth, the differences among the boards are a little more apparent, showing a 12 percent difference between the fastest performers among the PCI cards (the three ATI products) and the slowest (the STB Nitro 3D). More than half the cards we tested actually support 32-bit color depth at 1,024-by-768 resolution; the leader here was the Diamond Fire GL 1000 Pro, a midlevel card aimed at CAD, graphics, and 3-D professionals.

This year we also tested at 1,280-by-1,024 resolution with 16-bit color because each of the boards came equipped with at least 4MB of memory and could support that mode. As resolution and color-depth demands increased, we saw more differentiation among boards. Here the top performer was the Number Nine Revolution 3D, our Editors' Choice for power users and business and graphics professionals.

WinMark 98 The ZD Business Graphics WinMark 98 tests completely isolate the graphics subsystem from the test-bed computers and specific applications. Here we see a wider performance spread than on the Winstone 98 tests, which seek to replicate real-world situations. The effect of these "low-level" results on the overall computer system can range from marginal to significant—so be aware that wide margins between WinMark scores can be misleading. For example, at 1,024-by-768 resolution and 16-bit color depth, the AccelGraphics AccelStar II posted a Business Graphics WinMark score of 106, and the Hercules Stingray posted an 89—a large margin. But on Winstone 98—a measure of *overall* system performance—the margin among the scores is only about 2 percent.

When the WinMark margin widens to about 40 percent, as is the case with the Number Nine Revolution 3D (114) and the Jazz Adrenaline Rush (59), we see corresponding Winstone numbers differing by 12 percent—which is a big enough performance gap to be perceptible.

More striking is the significant impact the graphics subsystem has on overall system performance. For instance, the WinMark difference (at 1,024-by-768 resolution and 32-bit color depth) between the BioStar Venus 3D Rush (290) and Matrox Millennium II (99) is almost 70 percent. This leads to a very significant difference of 25

percent in overall system performance as measured by Winstone 98.

High-End Winstone Because our \$300 price filter netted us both mainstream accelerators and those targeted at more demanding graphics and CAD professionals, we added a layer of Windows NT

2-D Benchmark Tests

Bold type denotes first place within each category.

1,024 x 768, 16-bit color

**ZD Business
Winstone 98**

**ZD Business
Graphics WinMark 98**

PCI CARDS (Pentium/233 test-bed)

AccelGraphics AccelStar II	17.2		106	
ATI All-in-Wonder Pro	16.2		107	
ATI Xpert @Play	18.5		105	
ATI Xpert @Work	18.9		108	
BioStar Venus 3D Rush	15.7		80	
Canopus Total3D 128V	16.6		94	
Diamond Fire GL 1000 Pro	17.3		108	
Diamond Stealth II S220	18.5		89	
Diamond Viper V330	16.5		95	
ELSA GLoria Synergy	17.2		98	
ELSA Winner 2000/Office	17.3		105	
Hercules Dynamite 3D/6L	17.1		108	
Hercules Stingray 128/3D	16.8		89	
Intergraph Intense 3D Voodoo	15.8		67	
Jazz Adrenaline Rush 3D	15.4		59	
Leadtek WinFast 3D L2300	16.4		82	
Matrox Millennium II	17.1		108	
Metabyte Gla 3D DX	17.1		95	
Number Nine Revolution 3D	17.4		114	
STB Nitro 3D	15.9		93	
STB Velocity 128	16.7		82	
VideoLogic Apocalypse 5D	16.9		94	

AGP CARDS (Pentium II/266 test-bed)

AccelGraphics AccelStar II	21.5		120	
ASUS 3DexPlover 3000	21.0		112	
ATI All-in-Wonder Pro	22.0		137	
ATI Xpert @Play	21.7		137	
ATI Xpert @Work	22.1		137	
Diamond Fire GL 1000 Pro	22.2		131	
Diamond Viper V330	21.6		112	
Matrox Millennium II	22.1		137	
Number Nine Revolution 3D	22.5		144	
STB Velocity 128	21.3		111	

BETTER ►

BETTER ►

N/A—Not applicable. This color mode was not available for this test

HARDWARE

Graphics Accelerators

testing and selected the six boards that are marketed for that operating system. Here again, results on our Winstone test suite (this time, ZD High-End Winstone 98) at 1,024-by-768 resolution and 24-bit color were tightly grouped despite a 10 percent spread in the corresponding High-End Graphics WinMark results. The top finisher in WinMark was the Matrox Millennium II; top honors for Winstone went to the AccelStar II. At 1,280-by-1,024 resolution at 16-bit color, the Millennium II had the best WinMark and Winstone scores. Note that we received 4MB versions of the ELSA GLoria Synergy and

the Number Nine Revolution 3D for testing, which adversely affected their performances; the other cards had 8MB, and these two entries are available in 8MB configurations as well.

3D WinMark As expected, scores on our ZD 3D Graphics WinMark 98 tests were grouped according to the 2-D/3-D chip employed by the boards. The nVidia RIVA 128 controller was the clear performance leader this time around. The three boards based on this chip—Canopus Total 3D 128V, Diamond Viper V330, and STB

1,024 x 768, 24-bit color		1,024 x 768, 32-bit color		1,280 x 1,024, 16-bit color	
ZD Business Winstone 98	ZD Business Graphics WinMark 98	ZD Business Winstone 98	ZD Business Graphics WinMark 98	ZD Business Winstone 98	ZD Business Graphics WinMark 98
N/A	N/A	16.6	91	16.9	104
16.4	96	N/A	N/A	16.0	106
16.4	97	N/A	N/A	16.3	104
16.5	97	N/A	N/A	16.6	106
N/A	N/A	12.2	29	14.9	52
N/A	N/A	16.1	76	16.5	90
N/A	N/A	16.9	91	17.0	106
N/A	N/A	15.5	64	16.2	67
N/A	N/A	16.0	74	16.4	89
N/A	N/A	14.9	58	16.0	73
N/A	N/A	16.6	83	16.9	100
15.9	93	N/A	N/A	16.9	105
N/A	N/A	14.7	51	16.6	85
N/A	N/A	13.1	48	15.7	63
N/A	N/A	11.9	28	14.6	50
N/A	N/A	15.5	64	16.0	81
N/A	N/A	16.9	99	16.8	106
16.2	80	N/A	N/A	16.4	89
N/A	N/A	16.6	85	17.1	109
15.1	80	N/A	N/A	15.4	88
N/A	75	15.9	N/A	16.4	91
16.3	78	N/A	N/A	16.4	90
N/A	N/A	21.0	100	21.4	119
N/A	N/A	20.2	86	21.0	105
N/A	N/A	21.4	115	21.7	134
N/A	N/A	21.4	106	21.4	134
N/A	N/A	21.5	116	21.6	134
N/A	N/A	21.5	108	22.9	130
N/A	N/A	20.4	86	21.0	107
21.0	126	N/A	N/A	21.9	135
N/A	N/A	21.4	108	21.9	136
N/A	N/A	20.5	85	21.0	108
BETTER ►	BETTER ►	BETTER ►	BETTER ►	BETTER ►	BETTER ►

BENCHMARK TESTS

continues

Velocity 128—held a nearly 20 percent lead over most other PCI boards when we tested at 640-by-480 resolution. The next performance group contained representatives of three different chip sets. These were the ATI Rage Pro, employed by ATI's All-In-Wonder Pro and Xpert @Play; the 3Dfx Voodoo Rush, on Intergraph's Intense 3D Voodoo; and the 3Dlabs Permedia 2, on the Hercules Dynamite 3D/GL. The Number Nine Revolution 3D was enlivened by the company's own Ticket2Ride chip.

Down the 3-D performance staircase were several other entries with less optimized drivers based on the Permedia 2 and Voodoo Rush chips. This performance group, over 65 percentage points behind the leader, includes the VideoLogic Apocalypse 5D, which employs the VideoLogic/NEC PCX2; the Metabyte Gia 3D DX, which uses the S3 ViRGE/DX; the STB Nitro 3D, which uses the S3 ViRGE GX; and the Matrox Millennium II, which employs the company's own MGA-2144W chip.

When we ran 3D WinBench at 800-by-600 resolution, the lineup changed somewhat, and memory amounts became more important in some instances. Although they were configured only with 4MB of frame buffer memory, the ability of the PCI-based nVidia boards to transfer textures efficiently from system memory across the PCI bus allowed those boards to remain at the top. ATI boards jumped up to second place, in part because all ATI boards have 8MB of RAM.

Test results on the AGP versions of these boards were similar, with boards equipped with the nVidia RIVA 128 at the top, and the ATI

Rage Pro boards tied for second place with the 3Dlabs Permedia 2-based entries. On our AGP tests, at 800-by-600 resolution, the ATI boards made a better showing, in part because they are all 8MB cards and because they support the complete AGP specification.

The faster 3-D boards support a wide array of 3-D rendering and lighting modes. When testing support for these modes, 3D WinBench makes sure that a board uses its own hardware only if the technician running the tests visually confirms that a particular mode is supported. The 3D WinBench test suite was written under the Direct 3D API, and Direct 3D works this way: If the graphics card hardware does not support a given mode, the computer's CPU processes the task through a HEL (hardware emulation) driver. If the hardware can support a required mode, the board's HAL (hardware abstraction layer) driver handles the task. This produces the best performance, because the board's 3-D hardware is then "turned on." 3D WinBench is programmed by the technician's responses on its quality tests (pass or fail) to know which tests can run in hardware and which are forced to run in software.

Video Tests On our MPEG-1 Video Playback tests, most boards were able to play the MPEG1 300-Kbps clip, which was zoomed to full-screen, without dropping any frames. The VideoLogic board, which used the Tseng Labs ET6100 chip set, dropped more than 100 frames because it supports only a video overlay window (its preferred method for video playback) when the display is set to 16-bit color depth. The Number Nine Revolution 3D and Matrox

Microsoft Windows NT Performance

	1,024 x 768, 24-bit color 3D High-End Winstone 98	3D High-End Graphics WinMark 98	1,280 x 1,024, 16-bit color 3D High-End Winstone 98	3D High-End Graphics WinMark 98
Bold type denotes first place.				
AccelGraphics AccelStar II	31.3	148	27.7	148
ATI Xpert @Work	28.9	140	27.8	149
Diamond Fire GL 1000 Pro	30.3	138	26.2	128
ELSA GLoria Synergy	28.5	133	26.4	145
Matrox Millennium II	30.2	159	28.4	162
Number Nine Revolution 3D	28.7	132	27.1	138
	BETTER ►	BETTER ►	BETTER ►	BETTER ►

short list.—James Karney

AccelGraphics Inc., Mipitas, CA; 407-531-4465; www.accelgraphics.com. Circle 503 on reader service card.

ASUS 3DexPlorer 3000

nVidia RIVA 128 chip, 4MB SGRAM, 1,600-by-1,200 resolution at 85-Hz refresh. Street price: PCI, \$160; AGP, \$180.

The ASUS 3DexPlorer 3000 is a good fit for the budget-minded business user or gamer looking for an inexpensive way to upgrade to 3-D. Just don't expect any bundled games or fancy extras.

For this review we received the AGP version only, since ASUS was putting the final touches on the PCI version. The no-frills drivers lack any adjustable settings other than those found standard in Windows 95's Display Properties dialog. Once

installed, however, the drivers are stable.

On our 2-D benchmark tests, the 3DexPlorer proved a capable performer at mainstream resolutions and color depths (1,024-by-768, 24-bit color). At 1,280-by-1,024, however, the ASUS card began to lag behind most of the other AGP cards (though you should note that these higher-powered cards are also higher-priced).

Where the 3DexPlorer really lived up to its promise was on our 3D WinMark tests: The card was second only to the Diamond Viper V330. Rendering of 3-D scenes on the AGP card was smooth, and image quality was great.

Potential buyers should note that the included 4MB of memory cannot be upgraded, a drawback if you plan to trade up to a larger monitor down the road. Still, if you're looking for top-notch 3-D

for a budget price and you don't need fancy features in your drivers, ASUS's card may well merit further exploration.—JK

ASUS Computer International, San Jose, CA; 408-474-0567; www.asus.com. Circle 504 on reader service card.

ATI All-In-Wonder Pro, Xpert @Play, Xpert @Work



All-In-Wonder Pro: ATI 3D Rage Pro chip, 4MB SGRAM (8MB maximum), 1,600-by-1,200 resolution at 85-Hz refresh. Street price: PCI, \$280; AGP, \$290.

Xpert @Play: ATI 3D Rage Pro chip, 8MB SGRAM, 1,600-by-1,200 resolution at 85-Hz refresh. Street price: PCI, \$240; AGP, \$250.

Xpert @Work: ATI 3D Rage Pro chip, 8MB

3-D Benchmark Tests

Bold type denotes first place.

ZD 3D Graphics WinMark 98

640 x 480 resolution

800 x 600 resolution

PCI CARDS (Pentium/233 test-bed)

AccelGraphics Accel Star II	218	194
ATI All-In-Wonder Pro	224	221
ATI Xpert @Play	220	220
ATI Xpert @Work	224	220
BioStar Venus 3D Rush	216	158
Canopus Total3D 128V	272	252
Diamond Fire GL 1000 Pro	206	179
Diamond Stealth II S220	256	198
Diamond Viper V330	278	260
ELSA GLoria Synergy	204	166
ELSA Winner 2000/Office	218	186
Hercules Dynamite 3D/GL	223	201
Hercules Stingray 128 3D	224	170
Intergraph Intense 3D Voodoo	224	185
Jazz Adrenaline Rush 3D	215	156
Leadtek WinFast 3D L2300	208	182
Matrox Millennium II	66	56
Metabyte Gia 3D DX	89	67
Number Nine Revolution 3D	178	120

BETTER ►

BETTER ►

Millennium II both dropped frames only at certain color depths (the Millennium II at 24-bit, and the Revolution 3D at 32-bit). Boards based on the S3 chips use S3's Scenic Highway architecture and achieve a low dropped-frame rate.

For PC testing, we used a Micron Millennia system equipped with a Pentium MMX/233 CPU, 32MB of RAM, a Western Digital 2.1GB hard disk, an 8X Hitachi IDE CD-ROM drive, a Creative Labs Sound Blaster AWE32 synthesizer (on the motherboard)

SGRAM, 1,600-by-1,200 resolution at 85-Hz refresh. Street price: PCI, \$220; AGP, \$230.

These three new cards from ATI Technologies offer something for every niche of the graphics market. Although all are based on ATI's Rage Pro chip set, each has a separate array of features corresponding to its particular audience. The Xpert @Work is a straight-ahead business graphics card, the Xpert @Play is a solid bundle for 3-D gamers and multimedia users, and the well-stocked All-In-Wonder Pro is ready for virtually any graphics task you throw its way. ATI has done an expert job with all three.

ATI is an enthusiastic proponent of the new AGP bus technology, and to date, ATI's implementation is significantly more full-featured than that of any other mainstream graphics vendor. ATI takes full

advantage of AGP's execute-mode texturing, command pipelining, sideband addressing, and full 2x-mode protocols. As a result, ATI products can pull relevant portions of 3-D textures directly from system memory into graphics at burst rates of up to 528 MBps.

The three boards share a common installation routine. Simply click a button to install the display drivers, ATI Video Player, MPEG clips, and on-line manual via the Installation Wizard. Three new folder tabs will then appear on the Windows 95 Display Properties screen, granting access to color correction, panning, hotkey definition, and screen adjustment, including refresh-rate selection and size/position fine-tuning.

All of the cards rely on ATI's own 3D Rage Pro accelerator, combined with fast

ZD 3D Graphics WinMark 98

640 x 480 resolution

800 x 600 resolution

PCI CARDS (continued)

STB Nitro 3D	86	57
STB Velocity 128	270	252
VideoLogic Apocalypse 5D	96	88

AGP CARDS (Pentium II/266 test-bed)

AccelGraphics AccelStar II	341	302
ASUS 3DexPlover 3000	478	435
ATI All-In-Wonder	367	337
ATI Xpert @Play	353	303
ATI Xpert @Work	366	341
Diamond Fire GL 1000 Pro	375	311
Diamond Viper V330	493	447
Matrox Millennium II	89	70
Number Nine Revolution 3D	213	141
STB Velocity 128	474	434

REFERENCE DESIGNS* (Pentium/233 test-bed)

Oak Technology Warp 5	158	104
Rendition Verite 2200	266	209
S3 VIRGE GX2	92	67
Trident Blaze 3D Ultimate	74	87

BETTER ►

BETTER ►

*Scores of products now in beta are presented for comparison.

with a 2MB add-on wavetable card, and a Proteon 1392 Plus Token-Ring network adapter. For our AGP testing we used a Micron Pentium II/266 system with 64MB of SDRAM.

For a complete explanation of our new benchmark tests, see the article "Inside PC Labs' Latest Benchmark Tests" in this issue's PC Tech section.—*Analysis written by Jeff Mace. Special thanks to Dave Morey, Allyn Vogel, Tom Franz, and Steve Williams of the Ziff-Davis Benchmark Operations group.*

SGRAM that uses the new industry-standard SODIMM socket for easy upgrades. The cards also have an AMC (ATI Multimedia Channel) connector for peripherals such as a standalone ATI-TV or DVD card.

The cards differ mainly in their support chips, I/O connections, and bundled software. The @Work is essentially a base-level card for business users, and is available with as little as 2MB of SGRAM (we tested the 8MB version). It comes bundled with a set of sober business applications: Simply 3D, PhotoSuite, WIRL, and 3D Models.

The @Play is tailored for PC gamers and users of 3-D applications. It builds on the @Work's configuration by adding an on-board PC-to-TV converter as well as S-video and composite outputs for connection to an external monitor. The @Play

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- Microsoft Windows 95/IE 4.0
- Microsoft IntelliMouse
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Personal Lease: \$107/Mo., 24 Mos.[†]
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- MS Home Essentials/McAfee VirusScan 3.1
- Microsoft Windows 95/IE 4.0
- Microsoft IntelliMouse
- 3 Year Limited* Warranty with 1 Year On-site* Service

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Personal Lease: \$89/Mo., 24 Mos.[†]
Order Code #501106

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Extend the Life of Your 2-D Card

What should you do if you own a good-quality 2-D graphics card that you don't want to part with? Two products, Diamond's Monster 3D (\$180 street) and Matrox's M3D (\$100 street) may provide the answer. These cards provide Direct 3D hardware acceleration to complement your existing graphics card.

Diamond's Monster 3D is built around the 3Dfx Voodoo 3D accelerator and has 4MB of EDO DRAM. The board supports all Direct 3D titles as well as games built for the 3Dfx Glide and WinGlide APIs, RealityLab 2.0, Intel's 3DR, and Criterion's Renderware. Diamond bundles a generous total of ten games.

The Monster 3D installs in any PCI slot, accepting output from the graphics card via a supplied pass-through cable and connecting directly to the monitor. This external configuration lets the Monster 3D work with most VGA and 2-D Windows accelerators.

Performance is stellar. In our 3D Graphics WinMark tests (performed using a Matrox Millennium II graphics card), the Monster 3D outperformed the fastest 2-D/3-D accelerators currently on the market.

Matrox's M3D is equipped with NEC's PowerVR PCX2 chip and 4MB of SDRAM. The board supports all Direct 3D and GL Quake titles and ships with two titles. The M3D is compatible with all Direct Draw-enabled graphics cards. Install it in any PCI slot, and the card transfers 3-D data to the graphics card over the bus, requiring no special connector.

Matrox was still performance-tweaking its M3D drivers at test time; we saw a speed improvement over the solo Millennium II on our test-bed, though the improvement was less dramatic than the Monster 3D's impact.

During informal testing of the games shipped with each product, both boards produced over 30 frames per second on most games, and both produced high-quality 3-D graphics. Whichever board you choose, rest assured that it will deliver a quantum leap in 3-D performance—and extend the life of your trusty 2-D card.—*Jan Ozer*

Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846, 408-325-7000; www.diamondmm.com.

Matrox Graphics Inc., Dorval, Quebec, Canada; 800-844-8302; www.matrox.com.

called TV Magazine, which can create a transcript file (complete with captured stills) based on hotkey words or scheduled events. The player can generate MPEG and CD audio and show AVI and MPEG video playback. When it detects the All-In-Wonder Pro, the player can display video in from the TV tuner and capture video in Indeo Raw format at up to 30 fps in 640-by-480 resolution (assuming the attached PC is fast enough). Video quality is uniformly excellent: sharp, clear, and flicker-free.

Even better, these ATI offerings serve up excellent performance with their smorgasbord of features. The cards were in the top tier on our 2-D benchmark tests at all resolutions and color depths. We also included the @Work in our high-end Windows NT tests. The card's scores were respectably average.

Results on our 3-D benchmark tests were nearly as good: These cards were consistently among the top handful of finishers, and the Rage Pro chip supports an impressively wide array of Direct 3D features.

If you've got the extra cash, the All-In-Wonder Pro improves on its Editors' Choice-winning predecessor, the All-In-Wonder. The @Work and the @Play are also fine choices for users who don't need all the functionality of the All-In-Wonder Pro (and who don't want to pay for it). All three cards are worthy of careful consideration.—*Jon Hill*

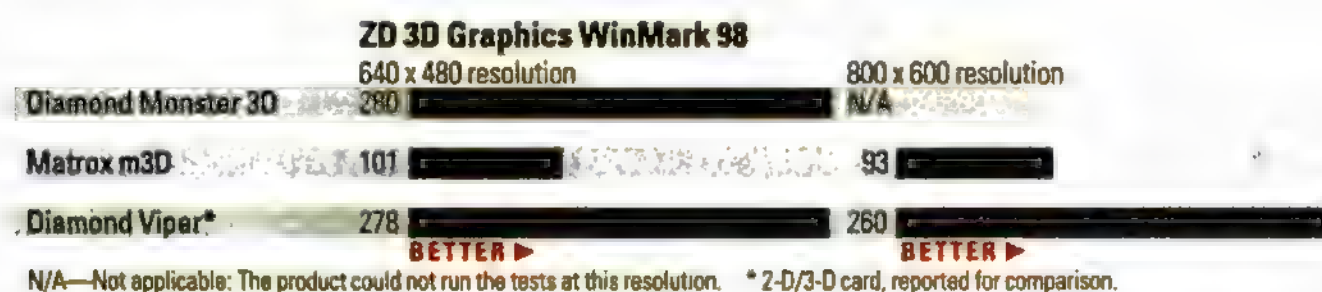
ATI Technologies Inc., Thornhill, Ontario, Canada; 905-882-2600; www.atitech.com. Circle 505 on reader service card.

BioStar Venus 3D Rush

3Dfx Voodoo Rush chip, 4MB EDO DRAM (6MB maximum), 1,600-by-1,200 resolution at 60-Hz refresh. Street price: PCI, \$250; AGP, \$270.

Targeted at the high-end gaming market, BioStar's Venus 3D Rush is an able 3-D gaming board, but 2-D performance falls short of the mark among current accelerators.

The Venus 3D Rush combines the 3Dfx Voodoo Rush chip for 3-D acceleration with the Alliance ProMotion VGA chip for 2-D. The board supports a range of resolution and color-depth modes, and should prove adequate for users of large-screen monitors. Setup was, fortunately, uneventful, and the bundled ProMotion driver allows you to control brightness, contrast, refresh rate, and screen center-



ships with two games that are fine-tuned for the chip set (Formula 1 and Terracide), in addition to Vream's WIRL 3-D browser.

ATI's 4MB All-In-Wonder Pro, the follow-up version to our Editors' Choice in this roundup six months ago, is a "convergence" board designed to combine all the graphics needs of SOHO users, home users, and 3-D gamers on a single card. Clearly the flagship of the line, the All-In-Wonder Pro comes with all the features of the @Play, plus a TV tuner. The card also has an S-video-in port and a TV-in cable connector, to give you the option of

watching TV, a videotape, or a DVD-ROM while you're waiting for all those 3-D titles to ship. The All-In-Wonder Pro comes bundled with Formula 1, MacroMedia Director 5.0, and VideoWave for video capture and nonlinear editing.

ATI has done a lot of work on its Video Player, which comes bundled with all three cards. The company has added full-motion instant replay with a user-adjustable 2- to 10-second delay, a channel scanner that displays selectable thumbnail-size previews of all available channels, and an enhanced closed-caption capture utility

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July 1997

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- Full 2D acceleration for Windows 95/NT
- Full 1D acceleration for Windows 95/NT
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SUMMARY OF FEATURES

Mainstream Graphics Cards



■ YES □ NO □ OPTIONAL

Products listed in alphabetical order

	AccelGraphics AccelStar II	ASUS 3DexPlorer 3000	ATI Xpert @Work	ATI Xpert @Play	ATI All-In- Wonder Pro	BioStar Venus 3D Rush	Canopus Total3D 128V
Price of tested configuration	\$280 street	\$160 street	\$220 street	\$240 street	\$280 street	\$250 street	\$230 street
AGP version available (price)	■ (\$280 street)	■ (\$180 street)	■ (\$230 street)	■ (\$250 street)	■ (\$290 street)	■ (\$270 street)	■ (\$230 street)
Graphics accelerator chip	3Dlabs Permedia 2	nVidia RIVA 128	3D Rage Pro	3D Rage Pro	3D Rage Pro	3Dfx Voodoo Rush	nVidia RIVA 128
RAMDAC speed	230 MHz	230 MHz	230 MHz	230 MHz	230 MHz	175 MHz	230 MHz
Tested/maximum display memory (type)	8MB / 8MB (SGRAM)	4MB / 4MB (SGRAM)	8MB / 8MB (SGRAM)	8MB / 8MB (SGRAM)	4MB / 8MB (SGRAM)	4MB / 6MB (EDO DRAM)	4MB / 4MB (SGRAM)
VGA pass-through connector/TV out		■ □ (\$10)	■ □	■ □	■ □	■ □	■ □
TV tuner/DVD decoder		□ (\$65)	□ (\$99)	□ (\$99)	■ □	□ (\$150)	
3-D stereo glasses output	■	■		■	■	■	
Display Features and Driver Support							
Maximum graphics resolution (refresh rate)	1,600 x 1,200 (75 Hz)	1,600 x 1,200 (85 Hz)	1,600 x 1,200 (85 Hz)	1,600 x 1,200 (85 Hz)	1,600 x 1,200 (85 Hz)	1,600 x 1,200 (60 Hz)	1,600 x 1,200 (85 Hz)
Maximum number of colors at:							
1,600 x 1,200 resolution	65,000	65,000	16.7 million	16.7 million	16.7 million	65,000	65,000
1,280 x 1,024 resolution	65,000	65,000	16.7 million	16.7 million	16.7 million	16.7 million	65,000
1,024 x 768 resolution and below	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million
Supports double-wide virtual display/16:9 aspect ratio	■	■	■	■	■	■	■
Drivers available for Windows 3.x/Windows 95	■	■	■	■	■	■	■
Drivers available for Windows NT 3.5 / 4.0	■	■	■	■	■	■	■
Drivers available for OS/2	■	■	■	■	■	■	■
Supports hardware zoom (highest zoom factor)		■ (4X)	■ (6X)	■ (6X)	■ (6X)	■ (8X)	
MPEG playback utility	Mediamatics Arcade	VCD Powerplayer	ATI Player	ATI Player	ATI Player	Xing MPEG Player	Active Movie
Supports OpenGL under Windows 95	■	■	■	■	■	■	■
Supports OpenGL under Windows NT 3.5 / 4.0	■	■	■	■	■	■	■
Full Installable Client Driver	■	■	■	■	■	■	■
Drivers available for AutoCAD/Microstation/Heidi	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
3-D texture modes supported:							
MIP mapping/Trilinear MIP mapping	■	■	■	■	■	■	■
Perspective texture correction/Palletized textures	■	■	■	■	■	■	■
Texture compression	■		■	■	■	■	■
Customer Support							
Toll-free technical support	■	■	■	■	■	■	■
Technical-support hours (eastern time)	8:00-11:00 M-F	12:00-8:00 M-F	9:00-7:00 M-F	9:00-7:00 M-F	9:00-7:00 M-F	9:00-5:30 M-F	9:00-5:00 M-F
Warranty	3 years	3 years	5 years	5 years	5 years	1 year	3 years
Web address (www._____)	accelgraphics.com	asus.com	atitech.com	atitech.com	atitech.com	biostar-usa.com	total3d.com

ing easily. Also included are several game demos and 3Dfx-specific feature demos.

Games are what Venus 3D Rush was designed to handle, and it handles them well. The board's scores on our 3D Graphics WinMark tests were admirable. The Voodoo Rush is also popular among game developers, so titles that take even better advantage of the chip's strengths are readily available.

Alas, 2-D performance was disappointing: The Venus was eclipsed by almost every other board on our 2-D test suite. If business productivity apps figure heavily into your plans, you should look elsewhere.—*Rob Glidden*

BioStar, Fremont, CA; 510-226-6678;

www.biostar-usa.com. Circle 506 on reader service card.

Canopus Total3D 128V

nVidia RIVA 128 chip, 4MB SGRAM, 1,600-by-1,200 resolution at 85-Hz refresh. Street price: PCI and AGP, \$230.

Canopus Corp.'s Total3D 128V is a 3-D gamer's dream that moonlights as a video-capture card. Some of the Total3D's video features are a bit rough around the edges, and its 2-D performance is uninspiring; but if fast-paced 3-D action warms your blood, this card is for you.

Installation under Windows 95 begins with a standard setup routine driven by an InstallShield Wizard. The wizard installs

the drivers, DirectDraw, Active Movie, and two proprietary video applications: Total Cinema EX and V-Shot. After a system restart, the wizard then installs a taskbar icon that lets you swap sizes and color depths, change the refresh rate, bring up a Refresh Utility sheet, access Display Properties, or go to the Online Manual for help.

The Refresh Utility sheet has two folder tabs: Desktop and Direct Draw. Both contain a matrix of resolutions and color depths, with each matrix point containing a scrollable list of available refresh rates. For example, the Direct Draw folder tab lists every Direct Draw resolution from 320-by-200 to 960-by-720; each color-depth/resolution combination has a corre-

Continues

Diamond Stealth II S220	Diamond Viper V330	Diamond Fire GL 1000 Pro	ELSA Winner 2000/Office	ELSA GLoria Synergy	Hercules Stingray 128/ 3D Model \$3310 TV	Hercules Dynamite 3D/GL	Intergraph Intense 3D Voodoo	Jazz Adrenaline Rush 3D	Leadtek WinFast 3D L2300
\$110 street	\$180 street	\$230 street	\$270 street	\$300 street	\$250 street	\$280 street	\$229 list	\$200 street	\$300 street
Rendition V2100	nVidia RIVA 128	3DLabs Permedia 2	3DLabs Permedia 2	3DLabs Permedia 2	3dfx Voodoo Rush	3DLabs Permedia 2	3DFx Voodoo Rush	3DFx Voodoo Rush	3DLabs Permedia 2
170 MHz	230 MHz	230 MHz	230 MHz	230 MHz	180 MHz	250 MHz	220 MHz	180 MHz	230 MHz
4MB / 4MB (SGRAM)	4MB / 4MB (SGRAM)	8MB / 8MB (SGRAM)	4MB / 8MB (SGRAM)	4MB / 8MB (SGRAM)	8MB / 8MB (EDO DRAM)	8MB / 8MB (SGRAM)	6MB / 6MB (EDO DRAM)	6MB / 6MB (EDO DRAM)	8MB / 8MB (SGRAM)
□ (\$130) □ (info not available)	□ (\$130) □ (info not available)	□ (info not available)	□ (info not available)	□ (info not available)	□ (info not available)	□ (info not available)	□ (info not available)	□ (info not available)	□ (info not available)
1,600 x 1,200 (60 Hz)	1,600 x 1,200 (85 Hz)	1,920 x 1,200 (70 Hz)	1,920 x 1,200 (73 Hz)	1,920 x 1,200 (73 Hz)	1,600 x 1,200 (60 Hz)	1,600 x 1,200 (75 Hz)	1,600 x 1,200 (70 Hz)	1,600 x 1,200 (60 Hz)	1,600 x 1,200 (75 Hz)
256	85,000	18.7 million	65,000	65,000	65,000	65,000	65,000	65,000	65,000
65,000	65,000	16.7 million	16.7 million	16.7 million	65,000	65,000	16.7 million	65,000	16.7 million
16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million
Mediamatics Arcade	Mediamatics Arcade	None	Compcore SoftPEG	Compcore SoftPEG	Xing MPEG Player	Xing MPEG Player	Xing MPEG Player	Compcore SoftPEG	ActiveX
8:00-10:00 M-F, 11:00-7:00 Sat.	8:00-10:00 M-F, 11:00-7:00 Sat.	8:00-10:00 M-F, 11:00-7:00 Sat.	8:00-5:00 M-F	8:00-6:00 M-F	6:00-6:00 M-F	6:00-6:00 M-F	10:00-8:00 M-F	12:00-8:00 M-F	8:30-6:00 M-F
5 years	5 years	3 years	3 years	3 years	5 years	5 years	5 years	5 years	1 year
diamondmm.com	diamondmm.com	diamondmm.com	elsa.com	elsa.com	hercules.com	hercules.com	ingr.com	jazzmm.com	leadtek.com

sponding selectable refresh rate. The card also comes with an ample software bundle, including Kai's Power GOO, Picture Publisher 7, Simply3D 2, and a sample CD loaded with demos of Direct 3D games.

Video is a big part of the Total3D's intended appeal. The card can accept an S-video or composite source as input, and can drive a high-resolution 800-by-600 external TV monitor through either type of connector.

The card also comes with Total Cinema EX, a software interface that uses Active Movie for a variety of audio/video functions, such as displaying live feeds, playing MPEG and AVI files, or playing audio CDs. It also captures AVI files.

Also bundled with the Total3D is V-Shot, a single-frame video capture application. V-Shot uses some impressive algorithms to eliminate motion blur and produces consistently sharp snapshots, although overall picture quality was uneven. We had to continually adjust brightness and saturation settings as we changed channels on a live cable feed, and display settings for snapshots did not match display settings in the V-Shot preview window.

Unfortunately, the Total3D relies on the sound card already present in a PC for audio. This arrangement can wreak havoc with audio/video synchronization over long AVI captures, and video-capture performance using the composite video-

in connector was mediocre. Our test-bed machine dropped numerous frames during a 30-fps capture at a resolution of 320-by-240, and we were unable to match captured-audio volume settings with the settings in our live feed. Numerous screen artifacts marred an occasionally crisp display: Vertical hold slipped in and out, and the screen was periodically unwatchable.

The nVidia RIVA 128 chip that drives the Total3D has an exceptionally fast triangle-setup engine and supports numerous Direct 3D features and effects. As a result, on our 3D Graphics WinMark 98 tests, the 128V posted top honors (alongside several other boards) among the PCI boards tested at both VGA and SVGA

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Mainstream Graphics Cards

Ends

■ YES ■ NO □ OPTIONAL

Products listed in alphabetical order

**Matrox
Millennium II**

**Metabyte
Gia 3D DX**

**PC MAGAZINE
EDITORS' CHOICE**

**Number Nine
Revolution 3D**

**PC MAGAZINE
EDITORS' CHOICE**

STB Alpha III

STB Velocity 128

**Videologic
Apocalypse 5D**

Price of tested configuration	\$300 street	\$100 street	\$240 street	\$100 street	\$200 street	\$270 street
AGP version available (price)	■ (\$300 street)	■	■ (\$300 list)	■	■ (\$200 street)	■
Graphics accelerator chip	MGA-2164W	S3 VIRGE/DX	Number Nine Ticket2Ride	S3 VIRGE/GX	nVidia RIVA 128	Videologic/NEC PCX2
RAMDAC speed	250 MHz	170 MHz	220 MHz	170 MHz	230 MHz	175 MHz
Tested/maximum display memory (type)	8MB / 16MB (WRAM)	4MB / 4MB (EDO DRAM)	4MB / 8MB (WRAM)	4MB / 4MB (EDO DRAM)	4MB / 4MB (SGRAM)	6MB / 8MB (MDRAM)
VGA pass-through connector/TV out	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
TV tuner/DVD decoder	□ (\$79) □ (\$129)	■ ■	■ ■	□ (\$129) ■	□ (\$129) ■	□ (\$99) ■
3-D stereo glasses output	■	■	■	■	■	■
Display Features and Driver Support						
Maximum graphics resolution (refresh rate)	1,920 x 1,200 (60 Hz)	1,600 x 1,200 (65 Hz)	1,920 x 1,080 (73 Hz)	1,600 x 1,200 (60 Hz)	1,920 x 1,080 (60 Hz)	1,600 x 1,280 (70 Hz)
Maximum number of colors at:						
1,600 x 1,200 resolution	16.7 million	65,000	65,000	256	256	65,000
1,280 x 1,024 resolution	16.7 million	16.7 million	16.7 million	65,000	65,000	16.7 million
1,024 x 768 resolution and below	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million	16.7 million
Supports double-wide virtual display/16:9 aspect ratio	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Drivers available for Windows 3.x/Windows 95	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Drivers available for Windows NT 3.5 / 4.0	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Drivers available for OS/2	■	■	■	■	■	■
Supports hardware zoom (highest zoom factor)	■ (4X)	■	■ (4X)	■ (32X)	■ (32X)	■
MPEG playback utility	CompCore SoftPEG	Active Movie	Active Movie	Mediamatics Arcade	Mediamatics Arcade	Xing MPEG Player
Supports OpenGL under Windows 95	■	■	■	■	■	■
Supports OpenGL under Windows NT 3.5 / 4.0	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Full Installable Client Driver	■	■	■	■	■	■
Drivers available for AutoCAD/Microstation/Heidi	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
3-D texture modes supported:						
MIP mapping/Trilinear MIP mapping	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Perspective texture correction/Paletted textures	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Texture compression	■	■	■	■	■	■
Customer Support						
Toll-free technical support	■	■	■	■	■	■
Technical-support hours (eastern time)	8:30-7:00 M-Th, 9:30-7:00 F	11:00-8:00 M-F	8:00-6:00 M-F	8:00-6:00 M-F	8:00-6:00 M-F	8:30-4:30 M-F
Warranty	3 years	5 years	5 years	Lifetime	Lifetime	5 years
Web address (www.)	matrox.com	metabyte.com	nine.com	stb.com	stb.com	videologic.com/ power.com

resolutions. Unfortunately, the RIVA 128 chip cannot support more than 4MB of on-board memory. Thus the Total3D does not support 3-D resolutions higher than 800 by 600 pixels, and games that use very large texture maps may run relatively slowly on this and other nVidia-based boards.

2-D graphics performance was less than stellar. The Total3D was markedly slower than the top-ranked boards on each of our Business Graphics WinMark 98 tests, but the card managed to hold its own on system-level Business Winstone 98 testing. Generally, graphics performance was consistent with other RIVA 128-based products. The Total3D 128V is best seen as a

killer gaming board with some intriguing video capabilities that need a bit of polish.—JH

Canopus Corp., San Jose, CA; 888-868-2533, 408-954-4502; www.total3d.com. Circle 507 on reader service card.

Diamond Fire GL 1000 Pro, Stealth II S220, Viper V330

Fire GL 1000: 3Dlabs Permedia 2 chip, 8MB SGRAM, 1,920-by-1,200 resolution at 70-Hz refresh. Street price: PCI, \$230; AGP price not available.

Stealth II S220: Rendition V2100 chip, 4MB SGRAM, 1,600-by-1,200 resolution at 60-Hz refresh. Street price: PCI, \$110.

Viper V330: nVidia RIVA 128 chip, 4MB

SGRAM, 1,600-by-1,200 resolution at 85-Hz refresh. Street price: PCI, \$180; AGP price not available.

This year, Diamond offers another outstanding crop of graphics cards targeted for a range of market segments. All of the cards offer corporate buyers consistently strong 2-D and 3-D performance, mature setup and configuration utilities, and a consistent look and feel that simplifies end-user support. Consumers seeking best-of-class performance for game play or software development—or simply highly functional, value-laden graphics cards—will also find the Diamond line worthy of attention.

All three boards ship with CD-

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CRT/VIS	21"/19.7"	17"/15.7"	15"/13.8"
MAX RES.	1600 X 1200 @ 85Hz	1600 X 1200 @ 68Hz	1280 X 1024 @ 60Hz
PITCH	0.25MM	0.26MM	0.28MM
WARRANTY	3 YEARS*	3 YEARS	3 YEARS

For more information, call 1 800 933 4110 or visit our web site at www.sosimple.com

CIRCLE 033 ON READER SERVICE CARD

*21" monitor includes a one-year on-site replacement warranty. ©1997 Samsung Electronics America, Inc. Software featured is 3D Studio MAX®, from Kinetix. Colorific is a registered trademark of Sonnetech, Ltd., San Francisco. All other brand, product and service names and logos are trademarks or registered trademarks of their respective manufacturers and companies. Ad: Arnell Group



June 1997 21GLs
July 1997 21GLs
August 1997 21GLs



May 1997 21GLs



June 1997 21GLs

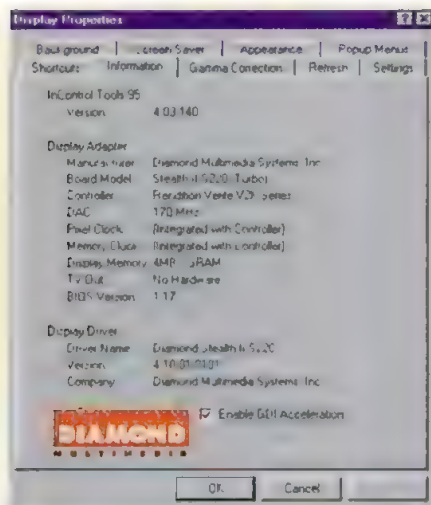


August 1996 21GLs
September 1996 21GLs
October 1996 21GLs
November 1996 21GLs
December 1996 21GLs



August 1996 21GLs

Graphics Accelerators



Diamond's In Control applet lets you access configuration settings, display options, and more.

ROM-based installations, and configuration wizards are included with the Stealth II and the Viper. Each card also ships with Diamond's sophisticated In Control Tools graphics utilities; the Stealth II and Viper offer the most extensive feature set, including color correction, on-the-fly refresh rate, color-depth and resolution adjustment, hotkey support, and configurable menus available with a right-mouse click.

STEALTH S220: A BARGAIN, AND WORTH IT

The Stealth II S220 is targeted at the budget-minded set, and adequate 2-D and strong 3-D performance make it a good bet for general corporate users and for thrifty consumers considering a graphics upgrade. The S220 cannot support high-resolution modes at higher color depths (the highest true-color resolution is 75-Hz at 1,024-by-768). The card's capabilities should be fine for mainstream home and corporate desktops, but are not suitable for big-screen graphics or video-related applications.

Unlike the other two Diamond cards, the S220 is Windows 95-only, with no Windows NT drivers available. The S220 does, however, support both of the Rendition 3-D APIs, plus Redline and Speedy, for maximum compatibility with all games that have Rendition-specific drivers as well as Microsoft Direct 3D. Diamond also includes a CD-ROM sampler containing six 3-D games.

On our 2-D Graphics WinMark tests, the Stealth's performance lagged behind that of its competitors. Scores on our Busi-

ness Winstone tests were generally better—within 5 percent of the category leaders, and indicative of ample capability for most business applications. Performance in 3-D was much better: The Stealth was one of the fastest 3-D cards we tested. Video playback quality was not as good as some of the other boards, however; the Stealth offers *x* and *y* video interpolation during scaling, but no filtering.

V330: UNSURPASSED 3-D SPEED

Diamond's Viper V330 offers extraordinary 3-D performance—the best in this roundup—plus outstanding video playback quality, solid 2-D performance, and an eclectic software bundle that will appeal to gamers and corporate users alike. The board includes composite and S-Video-out connectors for television display, and connectors for Diamond's DTV 2000 TV-tuner and video-capture add-in cards, which should be available in early 1998. With the V330, Diamond supplies drivers for Windows 95 and NT, and bundles four CD-ROM games, MGI's PhotoSuite, Asymetrix Web 3D, Vream's VRCreator, and Mediomatic's MPEG-1 software.

The V330 offers greater resolution options than the S220, and is more suitable for big-screen displays. With three-tap filtering and on-board color-space conversion, MPEG-1 and AVI video playback appears smooth and alias-free at all resolutions.

On our 2-D tests, the V330 produced average WinMark scores in both its PCI and AGP configurations. Here again, Winstone scores (indicative of true application performance) were very close to the category leaders. The V330's 3-D scores, however, were extraordinary. The card should more than satisfy fast-twitch gamers now, and be ready to tackle 3-D business applications as they come along.

GL 1000 PRO: POWER-USER PROWESS

For graphics and 3-D developers, Diamond's Fire GL 1000 Pro provides excellent high-end 2-D functionality in both PCI and AGP models, rock-solid refresh rates at extremely high resolutions, and a useful software bundle with several valuable 3-D development tools.

The GL 1000 Pro offers a port for a StereoGraphics-compatible connector for external 3-D-shutter glasses, allowing

developers to see 3-D views in 3-D creation programs that support StereoGraphics, or to let gamers play titles that support StereoGraphics. The developer-oriented software bundle includes Caligari's TrueSpace 3 SE, Crystal Graphics' 3D Impact!, and Cosmo Software's Cosmo Player 2.0 (a VRML 2.0 browser).

In addition to Windows 95 and NT support, Diamond also provides drivers for OpenGL and Autodesk Heidi. Unfortunately, the GL 1000 Pro provides only basic controls for color depth, resolution, and refresh rate, with no color calibration—a valuable feature for the development applications towards which the card is targeted.

The GL 1000 Pro performed extremely well on most 2-D benchmark tests, capped by a second-place finish for its 1,024-by-768 16-bit Winstone score among PCI and AGP boards. The card also placed well in Windows NT Winstone testing, though all the boards were tightly grouped. The GL 1000 Pro was an average performer on the 3-D benchmark tests, with only minor quality irregularities.

Generally, the GL 1000 Pro's rock-solid, high-resolution capabilities and strong 2-D performance make it ideal for graphics and video editing. While 3-D performance is only average, the board's strong driver set and bundled programs should make it attractive to 3-D developers as well.

Diamond's Viper V330 is an ideal game board with outstanding 3-D performance and excellent video quality. With a competent set of Windows graphics control utilities and more-than-adequate 2-D performance, the V330 is suitable for most business and home users.

Finally, anyone on a budget will like the Stealth II S220's strong performance, as well as its wizard-assisted installation and bargain-basement price.—*Jan Ozer*
Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846, 408-325-7000; www.diamondmm.com. Circle 508 on reader service card.

ELSA Winner 2000/Office, Gloria Synergy

Winner 2000/Office: 3Dlabs Permedia 2 chip, 4MB SGRAM (8MB maximum), 1,920-by-1,200 resolution at 73-Hz refresh. Street price: PCI, \$270; AGP pricing not available.

Gloria Synergy: 3Dlabs Permedia 2 chip, 4MB SGRAM (8MB maximum), 1,920-by-1,200 reso-



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Graphics Accelerators

lution at 73-Hz refresh. Street price: PCI, \$300; AGP pricing not available.

ELSA is widely known in Europe as a maker of graphics cards for a variety of markets and applications. In America, however, it is known only for its specialized high-end cards. With its current product rollout, the company is attempting to expand its U.S. presence by entering the mainstream graphics market while continuing to upgrade its position in the high-end niche.

WINNER: WORTH A LOOK

ELSA's new mainstream product is the Winner 2000/Office, which is targeted at typical business consumers who need speedy 2-D acceleration, and good 3-D for after-hours gaming or the coming wave of 3-D business apps. This is a competent, well-priced board that deserves serious consideration.

The Winner 2000/Office's 230-MHz RAMDAC supports a wide range of screen settings; the 8MB version supports resolutions up to 1,920-by-1,200. And unlike other mainstream corporate accelerators,



ELSA's GLoria Settings offers preconfigured options to optimize application performance.

the card provides full OpenGL support for higher-end 3-D imaging applications.

On our 2-D benchmark tests, the Winner was a standout, scoring among the top tier in all resolution and color-depth modes. Its 3-D performance was good, though not stellar.

GLORIA SYNERGY: A CAD FOCUS

Unlike the Winner 2000/Office, the GLo-

ria Synergy is targeted at the CAD and professional-graphics markets, and comes with a set of drivers and add-on utilities that tailor the board's performance for the higher-end, more graphics-intensive audience.

The GLoria Synergy's defining characteristics are its robust driver and ample software bundle. The driver's GLoria Settings configuration panel contains preconfigured settings that can optimize OpenGL performance on the fly, for a long list of professional graphics applications (such as 3D Studio VIZ, 3D Studio Max, AutoCAD, Autodesk Mechanical Desktop, MicroStation, Unicenter, and more). The driver bundle also includes PowerDraft, a 2-D display list driver for AutoCAD R13 and AutoCAD LT; and POWERview 3D (a 3-D viewer that can be used either as a standalone or with AutoCAD R13, AutoCAD R14, or Autodesk Mechanical Desktop).

Unfortunately, the drivers that came with the GLoria Synergy we tested seemed to need one last performance tweak. The card was bested by the more mainstream Winner 2000/Office on every 2-D and 3-D performance test. GLoria Synergy turned in merely average scores across the board, though the Winner 2000/Office's results prove the similarly designed GLoria Synergy can do better.

Assuming that ELSA fixes the driver's performance shortcoming, the GLoria Synergy is a board well worth your consideration for professional graphics use. For typical corporate users, the Winner 2000/Office is a solid offering.—RG

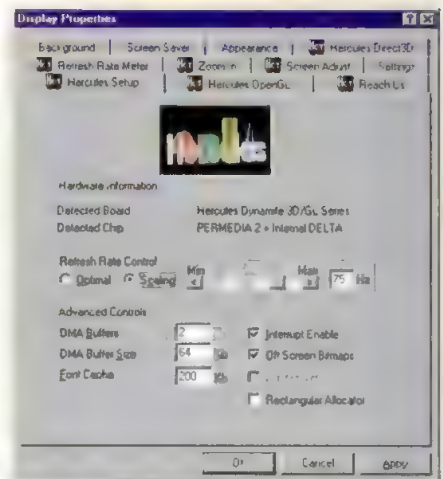
ELSA Synergy Inc., Santa Clara, CA; 800-272-3572, 408-919-9100; www.elsa.com. Circle 509 on reader service card.

Hercules Dynamite 3D/GL, Stingray 128/3D Model S3318 TV

Dynamite 3D/GL: 3Dlabs Permedia 2 chip, 8MB SGRAM, 1,600-by-1,200 resolution at 75-Hz refresh. Street price: PCI and AGP, \$280.

Stingray 128/3D: 3Dfx Voodoo Rush chip, 8MB EDO DRAM, 1,600-by-1,200 resolution at 60-Hz refresh. Street price: PCI, \$250.

Two different target markets make for two very different graphics boards from Hercules. The Stingray 128/3D, a high-end multimedia board designed for 3-D gamers, is sure to please its audience but isn't ideal for business. The Dynamite



Touch 95 from Hercules is one of the most advanced control utilities available.

3D/GL, dedicated to business users, shines under 2-D testing and nearly matches the 3-D performance of its cousin. The two cards have radically different designs that accomplish their tasks in different ways—and achieve some success, in both cases.

Installing both boards is simple under Windows 95, using Hercules's own Touch 95 control utilities. Touch 95 includes standard display-configuration and screen-adjustment functions, as well as some unique features, including a refresh-rate meter and Speedy, Hercules's 2-D performance monitor. The Entertainment Center, Hercules' virtual home stereo/VCR combo, provides a nicely unified, intuitive shell for audio and video playback.

STINGRAY: LONG IN THE TOOTH

The Stingray 128/3D is based on a split design, combining Alliance Semiconductor's ProMotion AT3D accelerator for 2-D and video functions with 3Dfx's Voodoo Rush engine, itself a two-chip solution for 3-D functions. The Voodoo Rush consists of a pixel engine, which shares the frame buffer's main memory with the ProMotion AT3D, and a texture engine with its own separate, dedicated block of memory. Thus, 4MB of the Stingray 128/3D's 8MB of EDO DRAM are permanently assigned to the Voodoo for texture storage; the rest is available for use by the ProMotion.

In our tests, the Stingray 128/3D flew through our 3D Graphics WinMark tests quickly and flawlessly at 640-by-480 resolution (a typical games mode). As with

9:23 a.m.

Check stocks. Market up.

11:16 a.m.

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1:33 p.m.

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Graphics Accelerators

other cards we tested, however, 3-D performance suffered at 800-by-600 (the resolution a business user is likely to use for 3-D), though that performance was still average. The Stingray 128/3D does not have enough memory for a Z-buffer at resolutions higher than 800-by-600 in 16-bit color, and does not support 3-D in true-color modes. The Alliance ProMotion chip performed in the middle of the group on our 2-D Business Winstone tests, and trailed the leaders even farther on the Graphics WinMark tests.

DYNAMITE: SOLID ALL AROUND

The Dynamite 3D/GL fared somewhat better across the board, thanks to its implementation of 3Dlabs' Permedia 2 accelerator. The Permedia 2 combines 2-D and 3-D operations on a single chip, and dynamically allocates all of its on-board memory to any task at hand; it even uses a few of its 3-D capabilities to accelerate some 2-D functions, such as pattern fills and video acceleration. The Permedia 2 also integrates 2-D, MPEG-2 video, and 3-D acceleration under both Direct 3D and OpenGL.

During testing, the Dynamite 3D/GL posted top-tier scores in our 2-D test suites, performing within fractions of a point of the leader in Winstone and among the leaders in WinMark. In 3-D testing, the card matched or bettered the Stingray 128/3D's quality and performance, and was again among the leaders.

The video quality of both boards was quite good; both are capable of displaying multiple simultaneous video streams with little apparent effort. Both boards also support a wide array of 3-D features and effects. During testing, the Stingray 128/3D correctly implemented perspective correction, specular highlights, alpha blending, fog, and several MIP-map modes (but not linear MIP-map combinations). The Dynamite 3D/GL matched its cousin feature by feature, though the driver we tested with had minor trouble with some fog modes.

In the rapidly changing world of PC graphics engines, the multichip Stingray 128/3D looks outmoded in comparison with new single-chip multifunction boards such as the Dynamite 3D/GL. The latter card offers greater flexibility and somewhat faster performance, with little noticeable trade-off in quality. While ded-

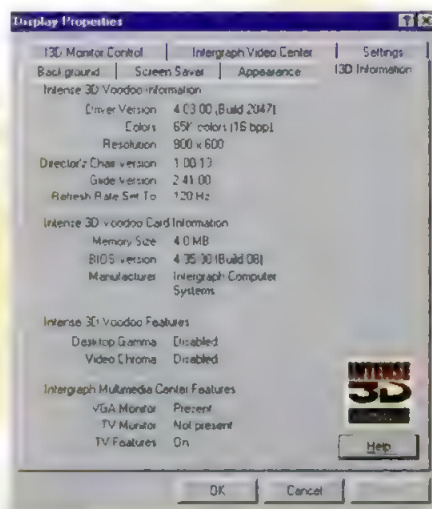
icated gamers may appreciate the Stingray 128/3D's high-quality 3-D output, general business users will be happier with the Dynamite 3D/GL.—*JH*
Hercules Computer Technology, Fremont, CA; 800-323-0601, 510-623-6030; www.hercules.com. *Circle 510 on reader service card.*

Intergraph Intense 3D Voodoo

3Dfx Voodoo Rush chip, 6MB EDO RAM, 1,600-by-1,200 resolution at 70-Hz refresh. List price: PCI, \$229.

If you're a PC gamer who wants top-notch 3-D performance, Intergraph's Intense 3D Voodoo is sure to please. Business users can find better 2-D acceleration for less money, but this board might be a good choice for a home machine that sees both work and play.

The Voodoo is built around 3Dfx's Voodoo Rush chip set (for 3-D) and Alliance Semiconductor's 128-bit ProMotion chip (for 2-D). The board includes composite and S-Video NTSC output



Intergraph's display utility lets you adjust image settings for your CRT and TV monitor.

ports (for viewing the PC image on a television), and a VESA-compliant stereoscopic port for 3-D glasses.

Software installation consists of only two steps: loading the Windows 95 drivers and control utilities, then loading DirectX. Intergraph's display-control utilities are excellent, enabling on-the-fly color depth, resolution and refresh-rate adjustment, and automatic screen centering. You can also adjust the sharpness, tuning, and contrast of video output to your tele-

vision and adjust monitor color, brightness, and contrast via a separate utility.

The ample software package includes driver support for DOS, Windows 95, and Windows NT 4.0, as well as for DirectX 5.0, GameGL, Direct 3D, and Glide 2.3+ (a Voodoo-specific game API). Three 3-D games round out the bundle. Third-party developer support for the 3Dfx chip set should also ensure a wide range of hot titles for some time to come.

The Voodoo placed in the back of the pack on most of our 2-D tests, though its performance should prove to be fine for most text-oriented business applications at mainstream resolutions and color depths. The board placed in the top quarter on our 3-D benchmark tests, behind boards built around nVidia's RIVA 128 chip set and closely grouped with boards using 3Dlabs' Permedia 2 chip.

Corporate buyers can find cheaper boards with superior 2-D graphics performance elsewhere. However, in terms of 3-D hardware and software game-play functionality, the Intense 3D Voodoo is a real contender.—*JO*

Intergraph Computer Systems, Huntsville, AL; 800-763-0242, 205-730-2000; www.intergraph.com. *Circle 511 on reader service card.*

Jazz Adrenaline Rush 3D

3Dfx Voodoo Rush chip, 6MB EDO DRAM, 1,600-by-1,200 resolution at 60-Hz refresh. Street price: PCI, \$200.

Jazz's Adrenaline Rush 3D is aimed squarely at PC gamers who want top-flight 3-D capability, ease of use, and a budget price. The card succeeds handily: The Adrenaline Rush 3D delivers solid 3-D acceleration and is less expensive than many comparable cards on the market.

The Adrenaline Rush 3D combines an Alliance ProMotion AT3D graphics engine for 2-D acceleration with a 3Dfx Voodoo Rush 3-D controller. The software bundle includes Turok Dinosaur Hunter, Interstate '76, and MechWarrior 2: Mercenaries.

Installing the Adrenaline Rush 3D is a snap under Windows 95. We liked the driver's extra touches, including an ability to set gamma and monitor levels for games via a control applet; there are slider bars that let you tweak each color chan-

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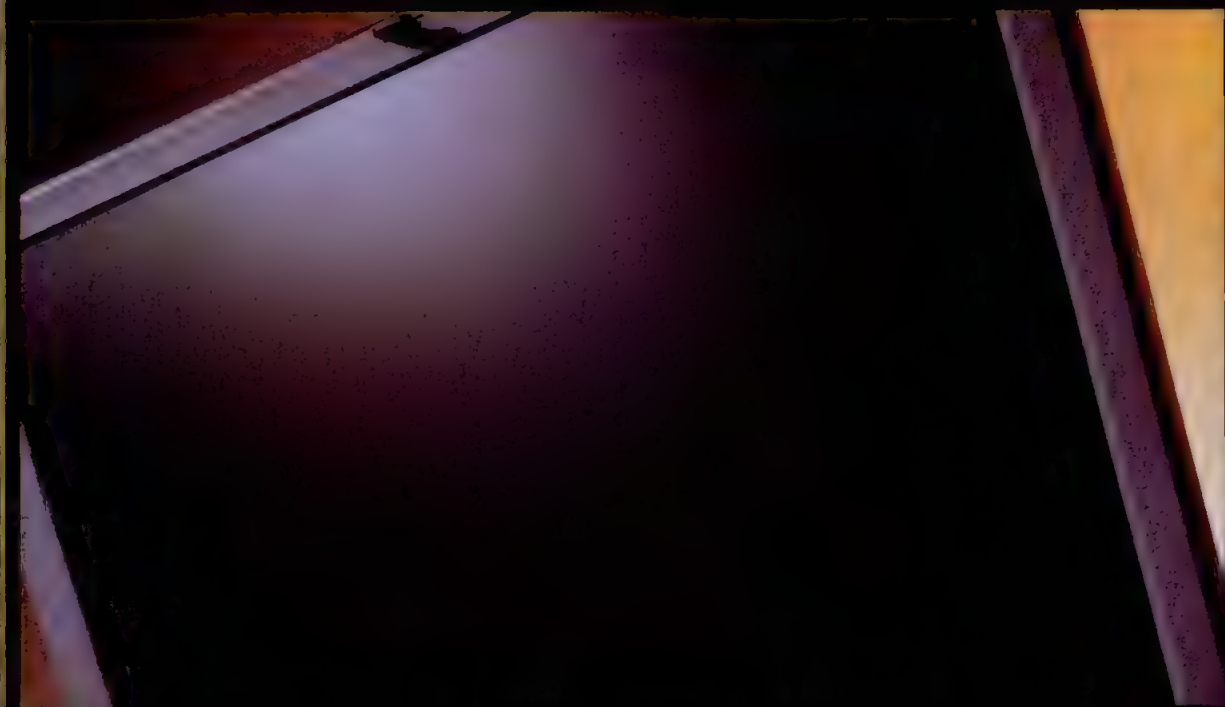
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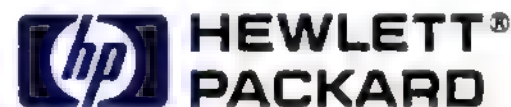
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nel. The manual could use a bit more coverage of the features, but all in all, there were few complaints with getting the Adrenaline Rush configured.

Like other boards that use the Alliance chip for 2-D, performance on our business test suites was lackluster. Especially at higher color depths and resolutions, the Adrenaline Rush 3D ran behind other boards on our Winstone and WinMark 2-D tests. For gamers and home users, however, the acceleration should prove to be adequate for typical Windows chores.

The board fared much better in 3-D performance, landing in the top quarter. The 3Dfx chip also supports more 3-D rendering modes than most, so image quality was excellent. More important, third-party support for the 3Dfx's proprietary GLide API means a steady stream of 3-D games that will boast even better performance.

If you're looking for a Voodoo engine at a good price and want a few new additions to your game library, this card may have just the magic you need.—*JK*
Jazz Multimedia Inc., Santa Clara, CA; 408-727-8900; www.jazzmm.com. *Circle 512 on reader service card.*

Leadtek WinFast 3D L2300

3Dlabs Permedia 2 chip, 8MB SGRAM, 1,600-by-1,200 resolution at 75-Hz refresh. Street price: PCI and AGP, \$300.

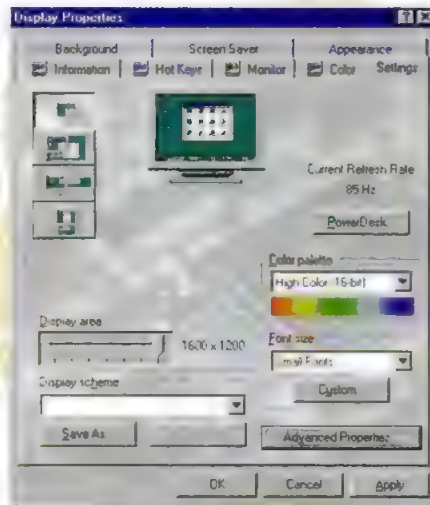
Leadtek's WinFast 3D L2300 is positioned as a general-purpose board for virtually all segments of the market. While the L2300 provides a good feature set and acceptable performance, it doesn't quite keep pace with other boards in its price class.

The card's integrated 230-MHz RAM-DAC allows resolutions of up to 1,600 by 1,200 at reasonable refresh rates, making the L2300 an acceptable choice for large-screen users. The card also supports OpenGL via a full Installable Client Driver. Leadtek includes a generous set of bundled software: ActiveMovie, 3D/FX and Digital Video Producer from Asymetrix, Microsoft Internet Explorer, and VDOLive Video Player from VDO.net.

On our 2-D benchmark tests, the L2300 was an above-average performer, though it didn't quite match the performance of other \$300 boards such as the

Matrox Millennium II and Number Nine Revolution 3D. Performance on our 3D Graphics WinMark tests was on a par with other Permedia 2-based boards—good, but not outstanding.

The WinFast 3D L2300 is a solid graphics board, thanks to the Permedia 2 chip set. But for the price, you may want to take a look at some of its competitors that deliver better performance.—*RG*
Leadtek Research, Fremont, CA; 888-532-3835, 510-490-8076; www.leadtek.com. *Circle 513 on reader service card.*



Matrox's MGA Settings tab lets you adjust your virtual desktop options with a single click.

Matrox Millennium II

Matrox MGA-2164W chip, 8MB WRAM (16MB maximum), 1,920-by-1,200 resolution at 60-Hz refresh. Street price: PCI and AGP, \$300.

The Matrox Millennium II is a top-notch 2-D graphics accelerator aimed at power users and graphics and CAD professionals who need a mature, trouble-free accelerator for use under Windows NT and Windows 95. Matrox is behind the industry curve on integrated 2-D/3-D acceleration, however, and corporate users can now find just-as-good 2-D and much better 3-D acceleration from competitors such as AccelGraphics, Diamond, and Number Nine.

Installation is simple and straightforward under both Windows 95 and Windows NT 4.0, and the Millennium II sports a full complement of display-control utilities. The MGA PowerDesk control panel now includes Desktop Navigator, a small desktop preview window that gives you

quick access to off-screen areas of your virtual desktop. MGA Diagnostic helps you troubleshoot display problems, and the MGA Settings folder tab contains descriptive icons that let you adjust your virtual desktop settings with a single click.

The Millennium II can maintain extremely high refresh rates at high resolutions and color depths, making it a good choice for large-screen applications.

Performance on our 2-D benchmark tests was consistently in the top tier, including on our High-End Winstone and WinMark test suites in Windows NT. The Millennium II placed dead last on our 3-D benchmark tests, and 3-D rendering quality was poor, as the chip set lacks support for many Direct 3D modes. Matrox offers a 3-D-only add-in, the M3D (\$99), to boost 3-D functionality for those who need it. In our testing, the M3D improved 3-D rendering speed dramatically, and image quality also improved.

If you play 3-D games, or if you think 3-D business apps are in your future, the Millennium II is not a good choice without the extra upgrades. But if your main priority is 2-D performance, the Millennium II will suit your needs admirably.—*JH*
Matrox Graphics Inc., Dorval, Quebec, Canada; 800-361-1408, 514-969-6300; www.matrox.com/mga. *Circle 514 on reader service card.*

Metabyte Gia 3D DX

S3 ViRGE/DX chip, 4MB EDO RAM, 1,600-by-1,200 resolution at 65-Hz refresh. Street price: PCI, \$100.

The bargain-price offering in this roundup, Metabyte's Gia 3D DX is based on the S3 ViRGE/DX chip set. Though it was one of last year's best 2-D/3-D solutions, today this chip is showing signs of age in the fast-evolving graphics market. With 3-D performance, you get what you pay for. But in 2-D the Gia 3D DX holds its own, which makes it an option for users who need 3-D acceleration only occasionally.

Installing the board was simple under Windows 95. Metabyte's software driver adds a convenient tab panel to your Windows Display Properties dialog, where you can adjust resolution, color depth, and monitor settings. Don't expect fancy extras such as TV-out or a great software bundle (only Microsoft Internet Explorer



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and ActiveMovie for MPEG playback are included). In case you ever need to update your drivers, Metabyte does provide an e-mail subscription service that will keep you apprised of the latest information.

While S3's ViRGE/DX supports a range of 3-D rendering functions, this previous-generation chip can't keep pace with the new kids on the block. The Gia 3D DX placed third from last on our 3D Graphics WinMark tests, beating only the STB Nitro 3D and Matrox Millennium II.

But don't write the Gia 3D DX off entirely. Its performance on our 2-D benchmark tests was actually quite good. It was a top-tier finisher on our Business Winstone and Business WinMark tests at mainstream resolutions and color depths.

If you're a bargain-basement shopper looking for a board with strong 2-D performance, and you aren't concerned about 3-D performance, the Gia 3D DX should fit the bill. At this price, you don't have much to lose.—RG

Metabyte Inc., Fremont, CA; 510-494-9700; www.metabyte.com. *Circle 515 on reader service card.*

Number Nine Revolution 3D



Number Nine Ticket2Ride chip, 4MB WRAM (8MB maximum), 1,600-by-1,200 resolution at 73-Hz refresh. *Street price: PCI and AGP, \$240.* Number Nine's Revolution 3D is a high-end graphics accelerator targeted for professional and business applications. Based on the Ticket2Ride chip, the company's own 128-bit graphics accelerator, both PCI and AGP versions of the Revolution 3D burned through our 2-D performance tests.

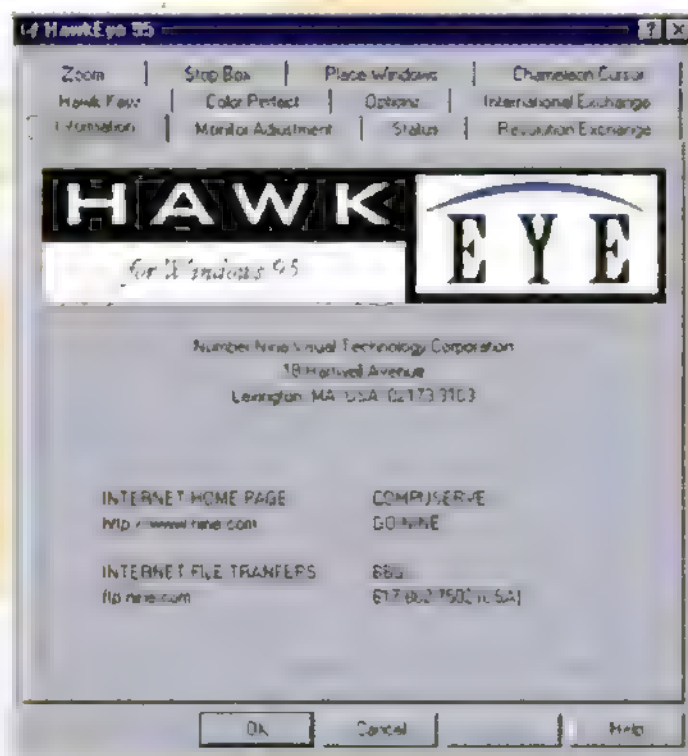
Installation was a snap under both Windows 95 and NT 4.0, and Number Nine's Hawkeye control utilities continue to be among the best in the business. Features include Board Information and Status Monitor screens, Color Perfect color correction, Monitor Adjustment tools, hotkeys, and a true 2X hardware zoom. There are also Place Windows commands to center message boxes in the virtual or current monitor-display area, a Chameleon Cursor to adjust cursor size and color, Resolution Exchange for on-the-fly resolution and color-depth swapping, and an Options

window that lets you enable Safe Mode support for advanced graphics modes.

The Revolution 3D ships with drivers for Windows 95 and NT 4.0, Internet Explorer 3.01, and a Star Trek MPEG screen saver. In keeping with its focus on high-end commercial users, Number Nine currently does not bundle the card with 3-D games, which would have been welcome at this price point.

Extending the raw power of its Imagine 128-based predecessors, the board offers broad 3-D support while maintaining fast 2-D and video performance. Our tests showed that the Ticket2Ride chip provides an excellent platform for Direct 3D games, but the chip should do equally well on high-precision OpenGL and Heidi applications under Windows NT, since it sports a full 32-bit z-buffer. The Revolution 3D's 128-bit memory path also leaves plenty of bandwidth for high-throughput rendering tasks. The Revolution 3D also has full block-write support up to a total of 16MB of RAM, and its 220-MHz RAMDAC delivers uniformly high refresh rates at high resolutions.

Performance was consistently excellent on our 2-D Business Winstone and Business WinMark tests: The card led the field in 1,024-by-768 resolution at 16-bit color depth as well as in 1,280-by-1,024



Number Nine's Hawkeye utility lets you zoom in, color-correct your screen images, and more.

resolution at 16-bit color. The Revolution 3D was a top finisher in 1,024-by-768 mode at 32-bit color depth, and it also fared well on our High-End Winstone and High-End WinMark test suites.

The card was less of a standout on our

3D Graphics WinMark tests, though it should prove more than able to perform occasional 3-D tasks. One disappointment was video performance: Because the chip handles video in an overlay window, the Revolution 3D was one of the few boards to drop a significant number of frames on our MPEG Video Playback test.

All in all an impressive extension of the company's 128-bit powerhouses, the Number Nine Revolution 3D deserves a close look from serious-minded professionals. While it is not meant to compete with gaming-oriented boards, the card has plenty of power and feature support for occasional forays into Direct3D while the boss is away.—JH

Number Nine Visual Technology, Lexington, MA; 800-438-6463, 781-674-0009; www.nine.com. *Circle 516 on reader service card.* STB Systems Inc.

STB Nitro 3D, Velocity 128



Nitro 3D: S3 ViRGE/GX chip, 4MB EDO DRAM, 1,600-by-1,200 resolution at 60-Hz refresh. *Street price: PCI, \$100.*

Velocity 128: nVidia RIVA 128 chip, 4MB SGRAM, 1,920-by-1,080 resolution at 60-Hz refresh. *Street price: PCI and AGP, \$200.*

STB delivers something old and something new this year. What's new is the Velocity 128, a high-performance board aimed at gamers and general users. A terrific all-around performer and a good value, the Velocity 128 will serve equally well in the home or in the office. The older card, the Nitro 3D, can't compete with the newest generation of accelerators on 3-D performance, but decent 2-D performance and a bargain price make it worth a look for budget-constrained users.

VELOCITY: STELLAR 3-D, GOOD 2-D

The Velocity 128 comes with a standard VGA connector and pass-through port, plus TV-out capabilities. Bundled software includes three 3-D games, Micrografx Simply 3D, a VRML browser, and a software MPEG decoder. Installation was hassle-free, and the driver controls are robust—more so than for the Nitro 3D—and are fully integrated into the Windows Display Properties dialog box. There are also user profiles, multiple desktops, and monitor image-centering controls, in

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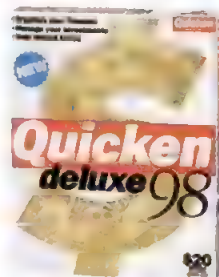
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Graphics Accelerators

addition to a zoom function, a bird's-eye view, and virtual desktop.

Once installed, the Velocity 128 behaved well, and 3-D games operated without any major problems. The card's performance on our 3D Graphics WinMark tests was excellent—the PCI version of the Velocity 128 was second only to the Diamond Viper V330, and by a margin not likely to be noticeable in real-world game play. The AGP version was a close third, behind the Diamond Viper V330 and ASUS 3DexPlorer (both based on the same RIVA 128 chip from nVidia). The Velocity 128 also turned in acceptable scores on our 2-D performance suites, showing it is equally adept for mainstream business users as well as fast-twitch gamers.

NITRO: BARGAIN-BIN MARKDOWN

The Nitro 3D is an older, PCI-only model that garnered our honorable mention in last June's roundup. Since then, it has been spruced up with new drivers that extend its 3-D abilities, but the Nitro 3D is not equal to newer designs on the market. This card is a good choice for those on a limited budget who need solid 2-D operations and some 3-D features for recreational use.

Easy to install and stable during operation, the Nitro 3D uses a separate application for adjusting features beyond the basic Windows menus. Like the Velocity 128, the Nitro 3D provides a zoom function, birds-eye view, and virtual desktop. The software bundle includes four games, plus a stripped-down version of Micrografx Simply 3D.

Performance on our 2-D benchmark tests was acceptable, if unremarkable; the card should prove to be fine for typical business and home-office chores at mainstream resolutions. 3-D performance was disappointing: The Nitro 3D scored next to last on our 3D Graphics WinMark tests. Better suited for occasional 3-D users than for gamers or graphics professionals, the STB Nitro 3D is best understood as a competent graphics board for general business users on a budget.

With respectable performance, well-thought-out features, stable drivers, and reasonable prices, these two cards from STB are good buys for their respective markets.—JK

STB Systems Inc., Richardson, TX; 888-

234-8750, 972-234-8750; www.stb.com.
Circle 517 on reader service card.

VideoLogic Apocalypse 5D

NEC/VideoLogic PCX2 chip, 6MB MDRAM (8MB maximum), 1,600-by-1,200 resolution at 70-Hz refresh. Street price: PCI, \$270.

The latest gaming board from VideoLogic marches to the beat of a different drummer. Unfortunately, it misses a beat or two along the way. Surprisingly, though the Apocalypse 5D is designed for high-end gamers, it provides much better 2-D acceleration than Direct3D performance. The software bundle is generous, and titles written directly to the PCX2 architecture perform well; for the price, how-



The easy-to-use icons in STB Vision make it simple to set virtual desktops, zoom, and more.

ever, you can get better overall performance elsewhere.

The Apocalypse 5D is available in either 6MB or 8MB configurations. In both cases, 4MB of SDRAM is dedicated to an integrated PowerVR PCX2 chip for storing textures, leaving only 2MB or 4MB of MDRAM for the actual graphics acceleration (performed by Tseng Labs' E6100 chip). This means that the 6MB version has too little memory to support a graphics resolution of 1,024-by-768 in 24-bit color, and the 8MB version cannot display a 1,600-by-1,200 resolution with 24-bit color. On the plus side, the texture memory allows for greater precision in drawing certain objects—particularly very near and very distant objects.

The board's dual-accelerator design complicates the installation procedure. VideoLogic recommends that you use its

interactive installation guide to install the driver software before you install the card in its slot. This idea is a good one, since Windows 95's default Plug and Play procedure doesn't seem to know what to do with the PCX2 chip; Plug and Play assigns the chip to the "Other Device" category and generates a message that asks you to install a driver for an "Unknown Device." But if you stick to the interactive guide, installation should go smoothly.

After installing the drivers and VideoLogic's SmartTools display utilities, a SmartDisplay wizard helps you group various parameters such as resolution, color depth, virtual desktop, and refresh rate. Once defined, switching between different groups is quick and intuitive. Gamers will appreciate the ample software bundle: The Apocalypse 5D ships with a healthy array of Direct 3D games fine-tuned for the PowerVR architecture.

On our testing, 2-D performance was quite good at mainstream settings. Performance on our 3-D tests was hampered by the unique design of the board. The integrated PowerVR accelerator does not use a z-buffer to store 3-D depth information; instead, an Image Synthesis Processor (ISP), integrated into the PowerVR chip, removes hidden surfaces in real time before applying shading, textures, or effects. Unfortunately, the PCX2 lacks support for several Direct 3D features, which brings down the card's overall score on our benchmark tests.

More important, the PCX2 has a relatively low limit on the number of polygons it can process, and the chip seems unable to swap textures within a frame. This doesn't affect most current 3-D applications, but these shortcomings will become more apparent as Direct 3D scenes become more complex. Even during testing for this review, visual quality suffered at times; polygons over the chip's limit were essentially thrown away, and the wrong textures appeared on 3-D surfaces.

While the unique architecture of the Apocalypse 5D provides some real benefits in 3-D image clarity, most users will be better off with one of the faster, more versatile single-chip accelerators from VideoLogic's competitors.—JH

VideoLogic Inc., San Bruno, CA; 800-578-5644, 415-875-6868; www.videologic.com.
Circle 518 on reader service card. 

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Net Tools



The NIC of Time

It's here. Fast Ethernet at a price and with a feature set that will make you forget about 10 Mbps.

By Tony Pompili

Fast Ethernet adapters are here en masse—at a price you can afford and with a feature set that makes considering old-fashioned 10-Mbps adapters, even on 10Base-T networks, just plain dumb. The way the market stands, you can get an adapter that will work on both 10-Mbps and 100-Mbps Fast Ethernet LANs for only \$20 more than the price of a 10-Mbps-only adapter. In fact, since the last time we tackled this subject ("Shifting into High Gear," December 19, 1995), the prices

for these devices have been cut in half.

Besides lower prices, Fast Ethernet has gained acceptance because, as promised, 100-Mbps Ethernet is compatible with existing 10-Mbps networks. This is crucial, as most sites are still running 10-Mbps hubs. Between price and compatibility, the old obstacles to 100 Mbps are rapidly falling away.

For this roundup, we looked at 15 10/100-Mbps adapters. We found that across the board these adapters are mature and ready for mass installation. All support Plug and Play (PnP) for Windows

INSIDE

FAST ETHERNET ADAPTERS:

The last time we corraled 10/100-Mbps adapters two years ago, the products were a nascent technology. Now, contributing editor Tony Pompili and contributors Robert P. Lipschutz and Jeffrey G. Witt conclude that their ease of use, solid performance, and support for the growing number of Fast Ethernet products makes them a wise investment.

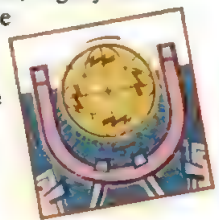


NETWORK PRINTING: Though our contributing editor Steve Rigney had a bear of a time getting the new Novell Distributed Print Services (NDPS) to run, it fulfills its promises by managing all network printers from a single utility. *Page 329.*

NETWORK MANAGEMENT:

HTML is everywhere, and increasingly, so is Java. The latest place you'll find these coconspirators is in SNMP-based network management software. Steve Rigney tackles Wipro's CyberManage and Asanté's IntraSpec—*in a head-to-head review. Page 329.*

INTERNET TOOLS: Working hard this time out, Rigney elucidates for us the vagaries of the routing built in to IntranetWare and Windows NT and how to conquer them. *Page 337.*



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Net Tools

10/100 NICs

95, and all provide the traditional set of drivers for MS-DOS, Windows 95, Windows NT, and NetWare. A few throw in Unix and Macintosh drivers as well.

All the adapters we reviewed are based on bus-mastering technology, which helps economize on CPU utilization by allowing network requests to bypass the processor and go straight to the adapter. All provide support for remote boot PROM and include diagnostics software. And every single adapter we tested includes N-WAY technology, which is used to auto-negotiate and auto-sense for full-duplex and 10/100 modes of operation. We also found that all the cards played well with our 10 and 100 hubs. And we didn't see the variations in performance we witnessed last time around (for details, see "What the Numbers Mean" and "How We Tested" in the benchmark test sidebar).

What we did see were differences in price and in management options. The street prices of these adapters range from \$45 to \$100. The higher-priced cards from vendors such as Digital, IBM, Intel, and 3Com included management software as well as SNMP agents. Also, each of these four companies develops so-called "enhanced" features and its own chip set, resulting in higher research and development costs, and thus higher prices. But for that investment, you get technologies such as Digital's Parallel Cut-Through architecture, Intel's built-in adapter fault tolerance, and IBM's Wake-On-LAN feature. If price is your primary concern, however, the \$45 to \$60 low-end cards probably offer the basic features you need, though most are completely unmanaged.

TAKING IT TO THE DESKTOP

Whether 100-Mbps networking is merely a twinkle in your IT department's eyes or a pending upgrade, you need to consider a few issues when contemplating taking Fast Ethernet to the desktop. If your users need to move large blocks of data across the network using imaging or publishing applications, for example, migrating to 100 Mbps at the desktop seems an obvious solution. But the economics aren't so clear.

Though adapter costs are a wash today, Fast Ethernet hubs and switches are still high-dollar items. With prices of between \$200 and \$250 per port for products such as SMC's Tiger Hub, as compared with \$100 or less per port for 10Base-T hubs, the budgetary rationale for sticking with 10-Mbps hubs for low-bandwidth applications is very easy to see.

100-Mbps switches, which give you a full Fast Ethernet segment per port, can send and receive up to 200 Mbps per port with full

duplexing. These are red-hot but expensive. Fast Ethernet switches cost between \$400 and \$500 per port, as compared with \$250 to \$350 for a 10-Mbps hub.

The bottom line is that many companies are still holding out for a hub or switch price point that is competitive with 10-Mbps equipment. But that doesn't mean you should sit on your hands. No matter which one best fits your environment, it's time to consider 10/100-Mbps adapters seriously for your next-generation machines. Need more convincing? Read on.

Accton Cheetah PCI Adapter

Bypassing the normal retail channels, such as CompUSA and Fry's, Accton has set its sights on directly marketing its Cheetah PCI Adapter (\$50 street) to small and medium-size businesses that want Fast Ethernet performance at Ethernet prices.

The only product in our roundup that does not include a manual, the Cheetah does have a short hardware installation description on the back of the packaging. You

are referred to a file on the floppy disk for software and driver installation. We did not experience any problems installing the adapter, however; Windows 95 auto-sensed it flawlessly.

A complete driver set includes the drivers for use with Windows 3.x, Windows 95, Windows NT, and NetWare, as well as LAN Manager, LAN Server, and SCO. Like many other adapters in this roundup, the Cheetah uses a DEC 21140AE chip set. And like the adapters from AccuLAN, Linksys, and Net-Gear, the Cheetah doesn't have any management options.

Accton is a Taiwanese company, but technical support is available through the Web and through a U.S. technical support phone number. A lifetime warranty protects the adapter.—Robert P. Lipschutz

Accton Cheetah PCI Adapter. Street price: \$50. Accton Technology Corp., Taiwan, R.O.C; 800-926-9288; fax, 408-452-8080; www.accton.com. Circle 520 on reader service card.

AccuLAN AL-10/100TXPCI

No longer the domain of technology innovators, Fast Ethernet adapters are coming from a host of obscure vendors, including AccuLAN. One of the no-frills adapters we reviewed, the AccuLAN AL-10/100TXPCI is,

EDITORS' CHOICE

- Intel EtherExpress PRO/100+ PCI Adapter
- 3Com Fast EtherLink XL PCI Network Interface Card



When it comes to Fast Ethernet adapters, you've got two camps—innovators and adopters. Since the last time we dissected this market, both groups have made

massive strides in terms of affordability and features. This made picking an Editor's Choice quite tough. After much deliberation, the Intel EtherExpress PRO/100+ PCI Adapter and the 3Com Fast EtherLink XL PCI Network Interface Card came out on top, with an honorable mention for the SMC EtherPower II 10/100.

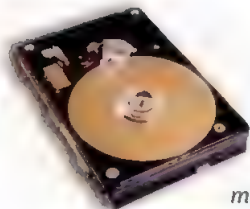
The adapters from Intel and 3Com have solid management software, full driver suites, lifetime warranties, and unlimited free technical support.

Intel and 3Com develop their own chip sets. This allows the vendors to provide

additional features, such as Intel's adapter fault tolerance (AFT) and 3Com's Smart Agents. The adapters also offer performance enhancements, especially when used with the companies' respective families of server adapters, hubs, and switches. And finally, both vendors will let you trade in your 10-Mbps adapters for 10/100-Mbps upgrades until the end of the year.

Our honorable mention goes to the SMC EtherPower II 10/100, representing the low end of the market. At only \$50 street, the EtherPower II includes management software and a full set of drivers.

Save the PC.



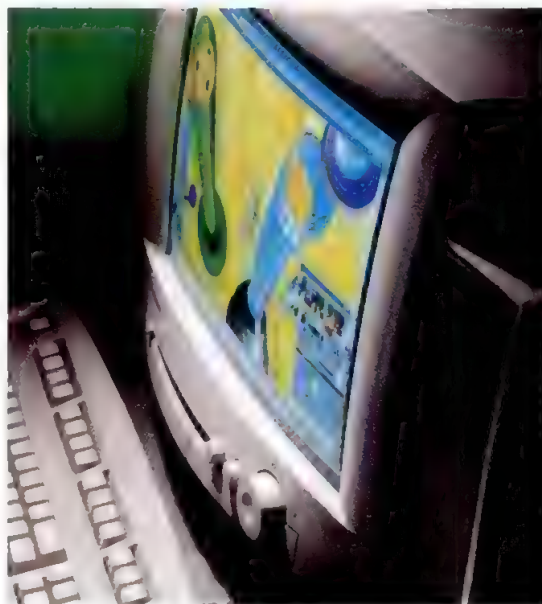
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	Medalist 6540	Medalist Pro 6451*	Medalist 5130	Medalist 4342*	Medalist 3232*	Medalist 2122	Medalist 1012
Capacity	6.5 GB	6.4 GB	5.1 GB	4.3 GB	3.2 GB	2.1 GB	1.0 GB
Spindle Speed	4500 RPM	5400 RPM	4500 RPM	4500 RPM	4500 RPM	4500 RPM	4500 RPM
Avg. Seek	11 msec	9.5 msec	11 msec	12 msec	12 msec	12 msec	12 msec
Max. Internal Data Rate	106 Mbits/s	116 Mbits/s	106 Mbits/s	88 Mbits/s	88 Mbits/s	88 Mbits/s	88 Mbits/s

*Performance subject to change without notice.

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Net Tools

10/100 NICs

along with the D-Link DFE-500TX, the cheapest, with a street price of \$45. The adapter, which is manufactured by Lite-On, a company based in Taiwan, is targeted at small and medium-size networks and can be found primarily in computer-supply catalogs.

We found the Windows 95 installation uneventful: You need only browse to the Win 95 directory on the driver disk after the operating system has found the new hardware. The documentation was adequate. It covers installation of the adapter, but all software configuration is in text files on the floppy disk. As for drivers, AccuLAN covers the expected bases—Windows 3.x, Windows 95, Windows NT, NetWare, and a few others.

Diagnostic software assists for troubleshooting, but no management features or SNMP agents are available. The AL-10/100TXPCI's on-board PNIC-100 chip set is the same one found in the Linksys EtherFast.

via phone or e-mail and is free for five years.—Jeffrey G. Witt

AL-10/100TXPCI. Street price: \$45. AccuLAN Inc., Sunnyvale, CA; 800-382-9249; fax, 408-245-3390; www.acculan.com. *Circle 521 on reader service card.*

Adaptec ANA-6911A/TX

Best known for its SCSI adapters, Adaptec has branched into the networking arena with ATM, Ethernet, and Fast Ethernet offerings. With its 1996 purchase of Cogent, Adaptec acquired a full line of Fast Ethernet products, including the ANA-6911A/TX. With a street price of \$75, it is among the more expensive adapters we looked at. But you do get SNMP support along with a lifetime warranty.

We didn't have any problems installing

the ANA-6911A/TX. The product's documentation is thorough, covering both hardware and software installations. Windows 3.x, Windows 95, Windows NT, and NetWare drivers will fulfill most needs, but NDIS 2.0, OS/2 SMP, SCO, and Solaris drivers are available as well.

As with the other adapters in this roundup, a diagnostic utility can check the adapter's settings and operation, but it is only available for a DOS environment, not for Windows 95. Also included with the network adapter is management software.

The adapter uses the DEC 21143 chip set, an upgrade of the chip set found on its Cogent predecessor, and has 100Base-T4 and fiber models available. Technical support is available through e-mail, the Web, and CompuServe.—RPL

Adaptec ANA-6911A/TX. Street price: \$75. Adaptec Inc., Milpitas, CA; 800-442-7274; fax, 408-262-2533; www.adaptec.com. *Circle 522 on reader service card.*

SUMMARY OF FEATURES

10/100 Ethernet NICs

■ YES ■ NO □ OPTIONAL	Acron Cheetah PCI Adapter	AccuLAN AL- 10/100TXPCI	Adaptec ANA- 6911A/TX	Addon AEF-380TX-D Fast Ethernet Adapter	Ansol 2890C PCI Fast Ethernet	Compaq Netelligent 10/100 TX PCI UTP Controller	Digital Fast EtherWorks PCI 10/100	D-Link DFE-500TX ProFast 10/100 Adapter
Products listed in alphabetical order								
List/street price	\$59 / \$50	\$59 / \$45	\$85 / \$75	\$59 / \$55	\$59 / \$50	N/A / \$80	\$119 / \$90	\$99 / \$50
Highest PCI version supported	2.00	2.10	2.10	2.10	2.00	2.00	2.01	2.00
Plug and Play for Windows 95	■	■	■	■	■	■	■	■
Full-duplex 10 Mbps/full-duplex 100 Mbps	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
LED power/network-status indicators	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
LED duplex/100-Mbps-link indicators	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Controller or processor	Digital 21140-AE	Lite-On LC82C168	Digital 21143	Digital DC21140-AF	Digital DC21140-AC	TI ThunderLAN	Digital 21143-PC	Digital 21143-PC
Remote boot PROM support	■	■	■	■	■	■	■	■
Network/board diagnostics	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Management software available	■	■	■	□	■	■	■	■
SNMP agent	■	■	■	□	■	■	■	■
Operating Systems								
DOS/Windows 3.x/Windows 95	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
NetWare/IntranetWare	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Microsoft Windows NT Workstation/Server	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Mac OS	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Sun Solaris X86/SCO Open Server	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
OS/2	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
PathWorks/VINES	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
LANtastic	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Warranty and Support								
Warranty	Lifetime	5 years	Lifetime	5 years	Parts only, 1 year	Parts, 3 years; labor, 1 year	Lifetime	Lifetime
Free support	Lifetime	5 years	2 years	5 years	1 year	Lifetime	Lifetime	Lifetime
Technical-support hours (eastern time)	9:00-9:00 M-F	8:00-5:00 M-F	24 hours, 7 days	10:00-8:00 M-F	8:30-5:00 M-F	24 hours, 7 days	8:00-5:00 M-F	9:30-9:00 M-F

N/A—Not applicable. The vendor does not cite a list price.

Addtron AEF-380TX-D Fast Ethernet Adapter

Clearly appealing to the low-end of the market with its \$55 street price, the AEF-380TX-D Fast Ethernet Adapter, from Addtron Technology Co., fits neatly into the low-frills, low-cost category. Like many of the products we saw, the Addtron adapter uses an off-the-shelf DEC 21140 chip set that contributes to the adapter's low cost. Nonetheless, we found the AEF-380TX-D installs as reliably as the other adapters do, although it requires a few extra steps.

Addron compresses its driver files onto a single floppy disk. Whereas other adapters simply asked for the driver disk during the Windows 95 install process, Addron has you first expand the disk. This makes setup a little less straightforward than for the other products. Similarly, the documentation provides little application-specific installation information, which would certain-

ly make the process a bit easier. Addtron does provide the standard array of Windows 3.x, Windows 95, Windows NT, and NetWare drivers. Management software is available as well, in the form of an optional SNMP agent.

Like AccuLAN and Linksys, Addtron only provides a five-year warranty, which is a bit on the short side. Technical support is available only Monday through Friday from 10:00 to 8:00, and is free for only five years. —*Tony Pompili*

AEF-380TX-D Fast Ethernet Adapter. Street price: \$55. Addtron Technology Co. Ltd., Fremont, CA; 888-233-8766; fax, 510-668-0699; www.addtron.com. *Circle 523 on reader service card.*

Ansel 2090C PCI Fast Ethernet

For those companies that don't mind sacrificing a little ease of configuration for a lower price, the Ansel 2090C PCI Fast Ethernet, from Ansel Communications, is worth a look.

While the adapter worked fine, it required more imagination during installation than many of the other products in this roundup, and it lacked management software as well. But at \$50 street, it's only underbid by the AccuLAN AL-10/100TXPCI.

It seemed to us that Ansel cut corners primarily in the area of documentation. Minimal installation instructions are provided in a scant eight-panel brochure, and Ansel leaves the software installation process up to the end user. But once we found our Windows 95 drivers, the adapter installed easily. Also, like many of the low-end adapters, Ansel's network interface card is based on DEC's 21140 chip set.

The Ansel 2090C does come with a wide variety of drivers, including those for Windows 3.x, Windows 95, Windows NT, and NetWare, and some solid diagnostic software, but you have to do a little hunting and pecking to find them.

Of the products in our roundup, the Ansel 2090C has the shortest warranty: a one-year, parts-only guarantee. And with only a year of free technical support, Ansel shares with Compaq the dubious distinction of offering the shortest such period we saw.—*TP*

Ansel 2090C PCI Fast Ethernet. Street price: \$50.
Ansel Communications Inc., Redmond, WA;
206-869-4928; fax, 425-869-5015; www.ansel.com. *Circle 524 on reader service card.*

Compaq Netelligent 10/100 TX PCI UTP Controller

NetFlex Ethernet adapters have been an option for Compaq servers for some time, but now Compaq has a full line of Netelligent networking products. We looked at the Netelligent 10/100 TX PCI UTP Controller, which at \$80 street is one of the more expensive (though more fully featured) adapters in this roundup.

The adapter is unique in its use of the Texas Instruments ThunderLAN chip set, which supports Ethernet, Fast Ethernet, and 100VG-AnyLAN, a standard now rarely seen. An SNMP agent can be loaded and viewed through Compaq's management utility, Insight Manager, and other SNMP management platforms. A DOS-based diagnostic utility is also included.

This bus-mastering adapter can auto-sense a 100-Mbps connection and supports Plug and Play just as the others we saw do. Consequently, we didn't have any problems getting it up and running. The documentation was merely average, centering around hardware specifications. You had to go to text files on the floppy disk for specifics on software driver installation. A full set of drivers that includes

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those for Windows 3.x, Windows 95, Windows NT, NetWare, and SCO Unix is included.

Technical support is available through Compaq's Web site, though it is free for only one year. You also receive a limited three-year warranty, one of the shortest in our roundup.—*RPL*

Compaq Netelligent 10/100 TX PCI UTP Controller. Street price: \$80. Compaq Computer Corp., Houston; 800-345-1518; fax, 281-518-1442; www.compaq.com.

Digital Fast EtherWorks PCI 10/100

As a Fast Ethernet innovator, Digital Equipment Corp. supplies the chip sets for most of the adapters in our roundup and offers a solid product of its own. Though on the high end of the price range at \$90 street, the Fast Ether-

Net Tools

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Works PCI 10/100 offers a full array of management comforts, comprehensive installation software, and a lifetime warranty.

Our Windows 95 setup went without a hiccup. The manual does a thorough job of explaining the adapter installation and the execution of the software install program and management options. We also liked the troubleshooting information and the clear instructions found in the manual for getting updates from Digital's Web and FTP sites, its BBS, and its forum on CompuServe.

The adapter ships with SNMP agents and NICworks, a local management package. NICworks wasn't compatible with our Windows 95 test client and is reported to be incompatible with Windows NT, but was compatible with the rest of the OS drivers provided.

The EtherWorks is based on the most recent 21143-BA chip set and offers Digital's own Parallel Cut-Through architecture. When paired with a Digital server adapter, the company claims you get greater throughput and minimal CPU utilization. And as mentioned, Digital offers a lifetime warranty and lifetime free technical support.—*JGW*

Fast EtherWorks PCI 10/100. Street price: \$90. Digital Equipment Corp., Littleton, MA; 800-859-1758; fax, 508-392-0603; www.networks.digitalcom. Circle 525 on reader service card.

D-Link DFE-500TX ProFast 10/100 Adapter

If you're looking for a low-cost, no-management Fast Ethernet solution built with industry-standard components, D-Link Systems' DFE-500TX ProFast 10/100 Adapter fits the bill. A street price of \$50 makes it,

BENCHMARK TESTS

10/100 Network Adapters



PC Magazine put 15 10/100 Ethernet network interface cards (NICs) through their paces in our labs, and found out that these cards, for the most part, performed just about the same on our Benchmark tests.

What the Numbers Mean

On our 100-Mbps tests, all of the computer systems were constrained by the sheer effort of putting that much traffic on the wire. Running at 10 Mbps with a block size of 32K, all of the cards delivered from 7.42 to 7.47 Mbps.

During our 100-Mbps tests, we saw slightly greater variance. All the cards reported throughputs of from 54.61 to 57.99 Mbps.

You'll probably wonder why you'd pay for 100 Mbps, only to find you can use little more than half of that bandwidth. First, keep in mind that the networking protocols—in this case, IPX/SPX—impose a significant overhead that isn't reported by throughput tests. Second, it is important to note that a Windows 95 client communicating with a Windows NT server doesn't have enough horsepower to send, acknowledge, and error-correct traffic and fill up the 100-Mbps pipe. If you were to place these cards in a server, you would see very different throughput numbers.

Our testing results show that the 10/100 technology is mature and worthy of your trust. There is no practical reason why you shouldn't buy 100-Mbps capability, even if you don't use it immediately. Our tests also show you should base your product selection on factors other than throughput. Look carefully at the warranty, price, and support policies of each company.

How We Tested

Our test-bed components were linked via an Intel Express 10/100 Ethernet switch. The client was a Dell Dimension XPX Pro200N with 32MB of RAM and a 2GB hard disk, running Windows 95 OSR2 with the NIC Throughput test (part of NetBench 5.0) from Ziff-Davis Benchmark Operation. The server was a Compaq ProLiant 5000 with 128MB of RAM and a 4GB hard disk, running Windows NT Server 4.0 with Service Pack 3 installed. The test controller was a Dell Dimension XPS P166 with 32MB of RAM and a 2GB hard disk, running ZDBOp's NetBench Controller software.

We ran two tests, one for 10 Mbps and one for 100 Mbps. NetBench generates a file on the server large enough so that it cannot be cached in memory on the client. The client then begins requesting the file repetitively, using the block sizes we specify in the NetBench test controller. The client times the download of the file and passes the result to the controller.—*Analysis written by Robert Norton*

High scores are best. Throughput (Mbps)	Client Throughput, 32K Blocks	
	100-Mbps mode	10-Mbps mode
Accton Cheetah PCI Adapter	56.76	7.46
AccuLAN AL-10/100TXPCI	56.98	7.47
Adaptec ANA-6911A/TX	57.69	7.48
Addtron AEF-380TX-D Fast Ethernet Adapter	57.35	7.47
Ansel 2090C PCI Fast Ethernet	57.49	7.46
Compaq Netelligent 10/100 TX PCI UTP Controller	54.61	7.47
Digital Fast EtherWorks PCI 10/100	57.02	7.46
D-Link DFE-500TX ProFast 10/100 Adapter	56.55	7.48
IBM 100/10 EtherJet PCI Adapter with Wake on LAN	56.86	7.45
Intel EtherExpress Pro/100+ PCI Adapter	58.00	7.47
Kingston EtherX PCI 10/100 Fast Ethernet Adapter	57.57	7.48
Linksys EtherFast 10/100 LAN Card	56.32	7.47
NetGear 10/100 Mbps PCI Network Card	56.93	7.47
SMC EtherPower II 10/100	57.17	7.47
3Com Fast EtherLink XL PCI Network Interface Card	56.88	7.43

Net Tools

10/100 NICs

with the Ansel 2090C, one of the least expensive products we saw. Only Acculan's adapter was cheaper, at \$45 street. The DFE-500TX uses the DEC 21143-PB chip set, and as with D-Link's other networking products, the adapter is aimed at smaller networks or workgroups.

The installation under Windows 95 is standard; you merely respond to the Plug and Play prompt for a driver with D-Link's floppy disk. The install program is less sophisticated than similar programs from Digital, Intel, and 3Com, but gets the job done. D-Link's documentation covers the rudiments of Fast Ethernet deployment and adapter installation, and offers minimal troubleshooting information. The expected Windows 3.x, Windows 95, Windows NT, and NetWare drivers are there, and you can easily download new drivers from D-Link's Web site.

D-Link doesn't offer any management options, and at first we couldn't find a diagnostic program (although we eventually downloaded one we found on the company's Web site).

Like many of the products in our roundup, the adapter has a lifetime warranty. Technical support is always free, but there is no toll-free number.—JGW

DFE-500TX ProFast 10/100 Adapter. Street price: \$50. D-Link Systems Inc., Irvine, CA; 800-326-1688; fax, 714-455-1261; www.dlink.com. Circle 526 on reader service card.

IBM 100/10 PCI EtherJet Adapter

If the first phrase you think of when someone says "LANs" and "Big Blue" is Token-Ring, you probably still have mainframes and 3270 terminals in your business. IBM now sells a full line of Ethernet products, and has embraced Fast Ethernet with its IBM 100/10 PCI EtherJet Adapter. This adapter is also available in a version with IBM's unique Wake-On-LAN feature, which powers up a PC when network traffic is encountered and provides for easier desktop management (\$120 street). But at \$100 street, the version without Wake-On-LAN is already the most expensive adapter in our roundup.

As for installation, we didn't have any problems putting the card on our Windows 95 machine. The included documentation is quite thorough and comes with a handy insert listing technical-support numbers and the company Web site's URL. IBM doesn't play favorites with software drivers, supporting its own LAN server, OS/2 Warp Server, as well as Windows 3.x, Windows 95, Windows NT, and NetWare.

The PCI Ethernet Adapter uses the Intel 82557 chip set, a change from the seemingly ubiquitous DEC chip sets used in these products. Management software is included with the adapter, along with a lifetime parts warranty and lifetime technical support.—RPL

IBM 100/10 PCI EtherJet Adapter. Street price: \$100. IBM Corp., Somers, NY; 800-426-3333; www.us.pc.ibm.com. Circle 527 on reader service card.

Intel EtherExpress PRO/100+ PCI Adapter



Always a network component innovator, Intel Corp.'s latest product, the EtherExpress PRO/100+ PCI Adapter, shows the company is still coming up with new ideas. Incorporating features, such as adapter fault tolerance (AFT), found in Intel's high-performance server NICs, the PRO/100+ is a good choice if you need great reliability.

In testing, we found the PRO/100+ simple to install. The card fit easily into the PCI slot in our test-bed, and Windows 95's PnP recognized it instantly. Intel also provides drivers for all the major OSs, including those for Windows NT, NetWare clients and servers, and OS/2. Like many of the adapters we saw, the PRO/100+ comes with management software but no SNMP agent.

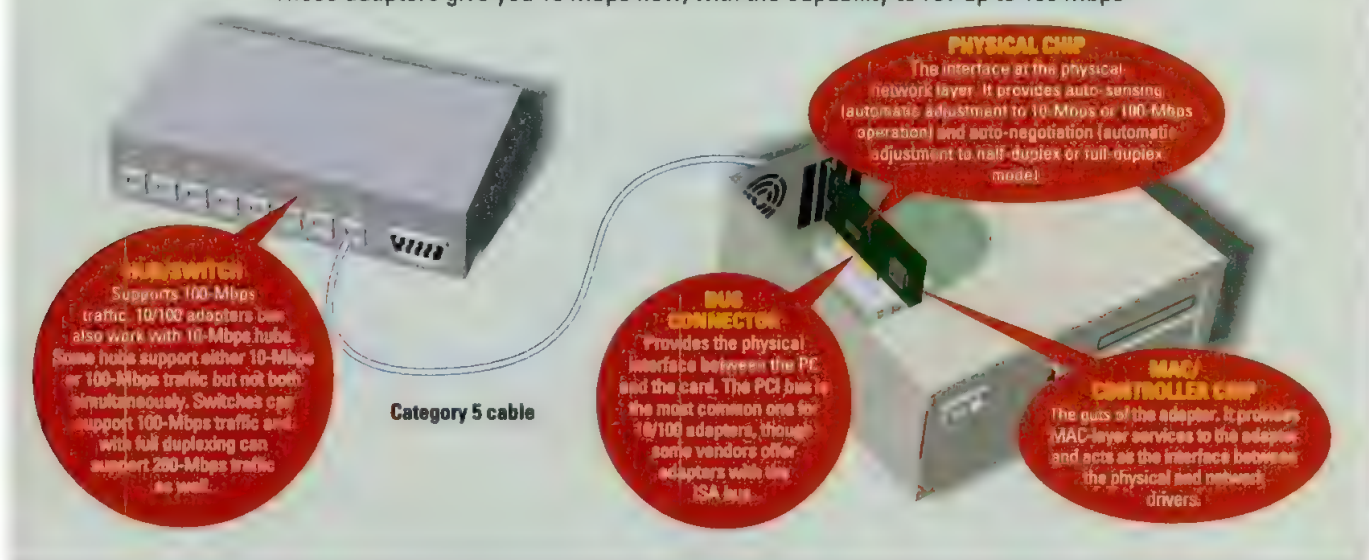
The PRO/100+ uses a proprietary Intel 82558 chip set that integrates both physical and controller functionality and, according to Intel, provides greater reliability. The PRO/100+ has inherited the AFT features of Intel's EtherExpress PRO/100 server adapter. AFT works with Windows NT clients and servers and NetWare servers but not with Windows 95 or other Windows OSs.

The adapter comes with a limited lifetime warranty as well as lifetime technical support. Intel is one of the few companies that provides free lifetime technical support around the clock.—TP

EtherExpress PRO/100+ PCI Adapter. Street price:

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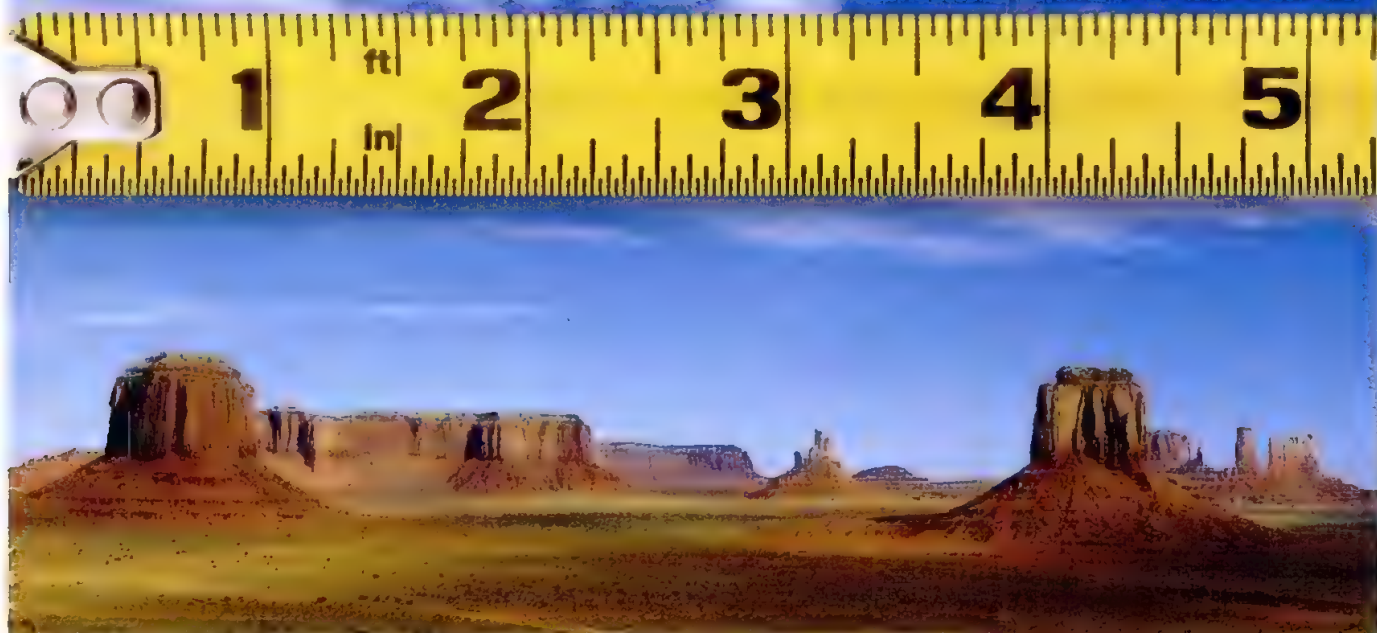
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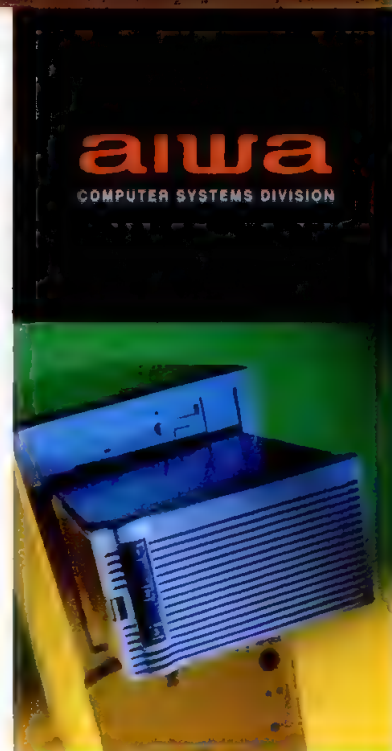


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10/100 NICs

\$85. Intel Corp., Santa Clara, CA; 800-538-3373, 503-264-7354; www.intel.com/networks. Circle 528 on reader service card.

Kingston EtherX PCI 10/100 Fast Ethernet Adapter

Focused on the small and midsize network markets, the EtherX PCI 10/100 Fast Ethernet Adapter, from Kingston Technology Co., is one of the most aggressively priced adapters in our roundup, with a street price of \$55. The adapter is available primarily through resellers, as are Kingston's lines of low-priced hubs and other adapters. Kingston Technology is owned by Softbank, which is also the parent company of *PC Magazine* and Ziff-Davis.

Kingston has abandoned its earlier, compressed-drivers-on-a-disk approach; installation is now performed via the DOS-based Qstart, for systems not running Windows 95.

The only snafu we encountered is that directly installing the EtherX will install the older, generic Windows 95 driver. You need to update the OS with the required drivers before installing the card. The EtherX provides drivers for Windows 3.x, Windows 95, Windows NT, NetWare, and various other OSs.

The documentation is decent, covering adapter hardware and software basics along with the obligatory Ethernet primer. Instructions for Windows 95 and Windows NT come on additional inserts. The EtherX includes an SNMP agent and a diagnostic tool.

Like many of the adapters we cover, the EtherX is based on the slightly older DEC 21140 chip set in order to reduce costs. For good adapters gone bad, Kingston offers a lifetime warranty and lifetime toll-free technical support.—JGW

EtherX PCI 10/100 Fast Ethernet Adapter. Street price: \$55. Kingston Technology Co., Foun-

tain Valley, CA; 800-435-2620; fax, 714-438-1879; www.kingston.com. Circle 529 on reader service card.

Linksys EtherFast 10/100 LAN Card

For a solid workgroup Fast Ethernet solution, Linksys's EtherFast 10/100 LAN Card may be the answer. Easy to install, the EtherFast was designed, according to Linksys, with the company's typical workgroup customer in mind. And with a street price of \$60, it fits right into Linksys's low-priced product line for lower-volume networks.

The adapter installed quickly and easily on our Windows 95 machines. The EtherFast comes with a comprehensive installation guide providing detailed instructions for a great variety of OSs, including Windows 3.x, Windows 95, Windows NT, and NetWare, as well as more obscure networking flavors such as DECnet and SCO Unix.

GIGABITETHERNET

Fast, Faster, Fastest!

No one can argue with the fact that Ethernet has shown a propensity for growth. The latest Ethernet incarnation—Gigabit Ethernet—is focused on the network backbone and will increase the maximum Ethernet bandwidth to 1 Gbps, 100 times that of traditional Ethernet. The standard for Gigabit Ethernet should be ratified in early 1998, and products will begin showing up en masse next year. Big networking players, such as Bay Networks and Cisco, will have offerings, as will a whole batch of start-ups, including Extreme, GigaLabs, and XLNT.

Ethernet has evolved in two ways. First, Ethernet switches increased the aggregate bandwidth of a network by separating conversations. With a switch, two or more conversations could go on unimpacted at close to 10 Mbps, whereas with a traditional hub, the conversations competed for the 10 Mbps of shared bandwidth.

Another evolutionary step was the increase in actual signaling speed from 10 to 100 Mbps. By changing the signaling scheme, Fast Ethernet gained an order-of-magnitude speed increase while still using two-pair Category 5 UTP or four-pair Category 3 UTP cabling.

Gigabit Ethernet devices will take Ethernet further yet, with another order-

of-magnitude increase in performance. This time, though, fiber will dominate. Although the Gigabit Ethernet standard committee is considering a copper solution, it appears that the length of the copper connection will be limited to 25 meters. We expect most initial solutions to

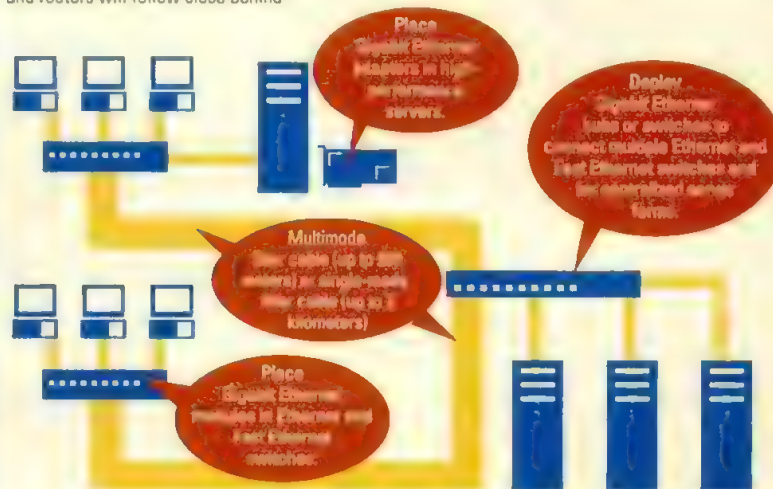
ship with fiber ports only.

Gigabit Ethernet products will focus on the network backbone, not the desktop, and should roll out something like this. First, Gigabit Ethernet hubs will emerge, followed by Gigabit Ethernet PCI adapters and Gigabit Ethernet modules for Fast Ethernet switches. Finally, you'll see some high-end Gigabit Ethernet switches.

To follow product announcements and progress on the standard, you can check out the Gigabit Ethernet Alliance (www.gigabit-ethernet.org).—RPL

Gigabit Ethernet

Initially, Gigabit Ethernet switches and hubs will target the network backbone and high-speed servers. Server adapters and uplink modules for existing switches and routers will follow close behind.



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NETObjects

Net Tools

10/100 NICs

The EtherFast does not provide either management software or an SNMP agent. It shares this shortcoming with adapters from AccuLAN, Ansel, and NetGear. It does, however, have a diagnostics utility.

Like AccuLAN's adapter, the EtherFast uses the PNIC chip set, which Linksys says was cheaper than licensing the technology from a company like DEC. And like AccuLAN and NetGear, Linksys provides only a five-year warranty. But you do get free lifetime technical support.—TP

EtherFast 10/100 LAN Card. Street price: \$60. Linksys Inc., Irvine, CA; 800-546-5797; fax, 714-261-8868; www.linksys.com. Circle 530 on reader service card.

NetGear 10/100 Mbps PCI Network Card for Pentium PCs FA310TX

In 1996, Bay Networks launched NetGear in order to penetrate the small-business and home office markets. And it has done so with a product line that includes the 10/100 Mbps PCI Network Card for Pentium PCs FA310TX. With a highly competitive street price of \$50, NetGear's adapter goes head-to-head with those from traditional low-cost leaders like D-Link, Kingston, and Linksys.

Although the manual includes an amusing typo stating that the adapter weighs a whopping 22 pounds, the card was indeed one of the larger ones in the roundup. Installation was fairly smooth, though we had to remove the DEC driver and add NetGear's. Documentation is decent, including hardware, software, and troubleshooting information, and is geared toward Windows 95 and ODI installations. The driver set includes the standard Windows 3.x, Windows 95, Windows NT, and NetWare drivers, as well as those for LANtastic and SCO Unix. The card uses the ubiquitous DEC 21140 chip set.

Like most of the lower-priced adapters, the FA310TX is completely unmanaged, though it does have a diagnostic utility. But this adapter does offer a lifetime warranty and free lifetime technical support.—RPL

10/100 Mbps PCI Network Card for Pentium PCs FA310TX. Street price: \$50. NetGear Inc., Fremont, CA; 888-638-4327; www.netgear.baynetworks.com. Circle 531 on reader service card.

SMC EtherPower II 10/100

A solid, reasonably priced PCI Fast Ethernet adapter from an established NIC vendor, SMC Networks' EtherPower II 10/100 provides

some of the most detailed installation instructions of the lot. And at \$50 street, the EtherPower II won't break the bank, whether you need

a couple of them or a couple of hundred.

The EtherPower II distinguishes itself from many of the other lower-priced adapters by being one of the only ones to provide both optional management software and an SNMP agent. And like NetGear's low-priced product, the EtherPower II comes with a lifetime warranty and a lifetime of free technical support.

SMC has done a nice job with the installation part of the task: It is one of the few vendors that provides detailed instructions geared to nearly all the leading OSs, including Windows 3.x, Windows 95, Windows for Workgroups, Windows NT, and NetWare. Various other OS drivers are available on the SMC SuperDisk provided with the adapter package. The EtherPower II is based on the company's own Epic chip set. According to SMC, this enables the company to more finely tune its drivers for greater performance.—TP

SMC EtherPower II 10/100. Street price: \$50. SMC Networks Inc., Hauppauge, NY; 800-553-7731; fax, 516-273-7935; www.smc.com. Circle 532 on reader service card.

3Com Fast EtherLink XL PCI Network Interface Card

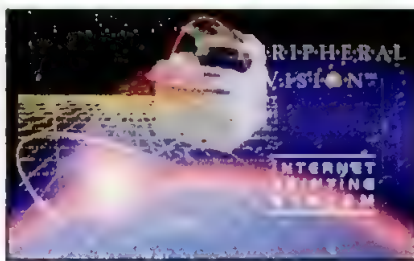


As the Ethernet originator, 3Com Corp. has continued to beef up its Fast EtherLink XL PCI Network Interface Card. Commanding a steep \$95 street price only topped by IBM's product, the card offers management and performance extras that justify its cost.

We found the Windows 95 installation straightforward; we had only to insert the driver disks. 3Com provides a comprehensive list of drivers, including those for Windows 3.x, Windows 95, Windows NT, NetWare, and various Unix flavors. The manual is extensive, covering the adapter, software, and diagnostics. One of the few with its own chip set, the EtherLink XL makes use of Parallel Tasking. According to 3Com, this optimizes performance and CPU efficiency by moving arriving pieces of data to the PCI bus without waiting for the entire chunk.

The adapter includes a solid diagnostic tool, which sends problem reports to technical support. As for management, besides SNMP, you can load SmartAgent drivers to

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Net Tools

10/100 NICs

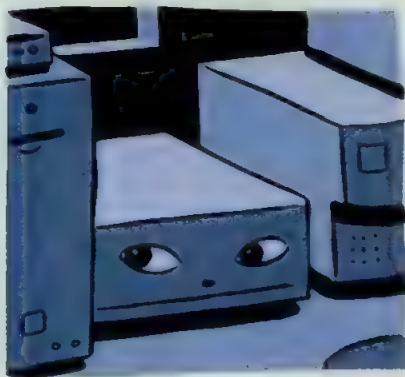
works' RealAudio. Like most similar products, the adapter ships with a lifetime warranty and lifetime technical support.—JGW

Fast EtherLink XL PCI Network Interface Card. Street price: \$95. 3Com Corp., Santa Clara, CA; 800-638-3266; fax, 408-764-5001; www.3com.com. Circle 533 on reader service card. **PC**

SERVERADAPTERS

Servers That Never Sleep

From the rest of our story, you've probably gleaned that the client side of the 10/100-Mbps market has most definitely matured. The same phenomenon is occurring in the 10/100-Mbps server adapter market as well. Lots of new technologies have been developed and implemented in the last couple of years that have improved both performance and reliability. These include fail-over, which is the latest adapter innovation to come along; multiport adapters that were first brought out by Cogent, which is now part of Adaptec; and hot-pluggability, a



feature available with Compaq and SMC adapters.

The biggest and arguably most important development in 10/100 server adapters is software-based fail-over. Fail-over allows a redundant adapter to take over network tasks in case of failure and inherit the primary adapter's network addresses without any interruption in service. Likewise, if the primary adapter doesn't respond within a specific time, produces an abnormal interrupt, or is deemed to have large amounts of traffic collisions, activity is rerouted to the secondary adapter. Monitoring and alerts

can be generated via SNMP, DMI, or other management hooks. This critical redundancy is now standard on adapters from Adaptec, Compaq, and Intel, and 3Com will soon join in. It works with both NetWare and Windows NT.

If you're concerned about using valuable PCI slots for redundant adapters, multiport adapters are now a viable option. These increase performance by letting you create separate wiring segments to reduce traffic bottlenecks. Dual-port configurations are available with the Adaptec ANA-6922A DUO (\$375), the Compaq Netelligent Dual 10/100 TX (\$419), and the SMC Dual-Channel EtherPower (\$289), or you can go a step further with the Adaptec Quartet 4-Port 10/100 adapter (\$998). Adaptec adds a separate performance twist with its DuraLink Manager software, by aggregating either multiports or several single-port adapters into one larger pipe. This scalable pipe can include up to 12 ports, in order to reach 1.2-Gbps capacities.

To minimize downtime for replacing prefabricated or failed adapters, you can expect new servers to accommodate a Hot Plug PCI replacement. The recently shipped Compaq ProLiant 6500 and 7000 series now offer five Hot Plug PCI slots. Besides Compaq's own Netelligent Fast Ethernet adapters, SMC has shipped its 10/100 adapter to work with the ProLiant. Quick online adapter-swapping takes place without power-downs for components that have failed-over or that management software such as Compaq's Insight Manager detects as performing abnormally. Future extensions of this technology should include a Hot PCI Upgrade to make changes to newer drivers or devices.—JGW

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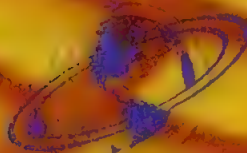
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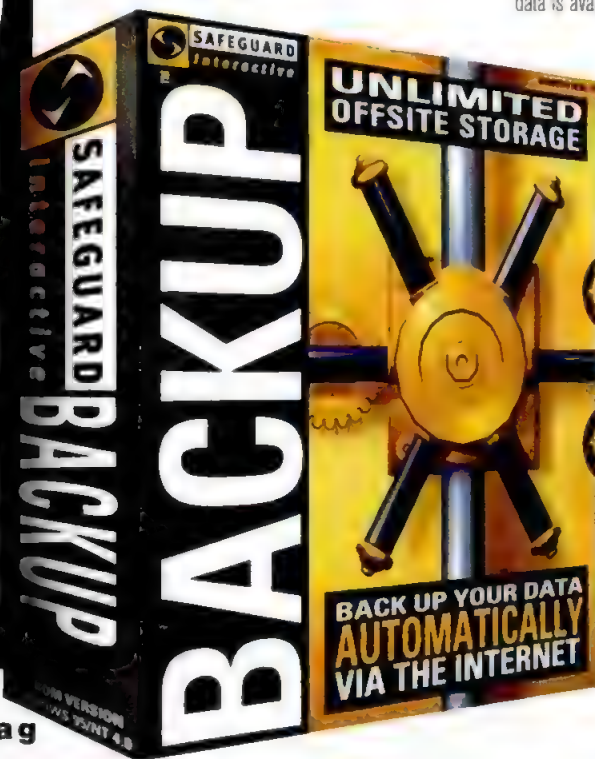
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Net Tools

FROM THE BENCH

NETWORK SERVICES

A New Way to Print

By Steve Rigney

To put it mildly, printers can be one of the bane of a network administrator's existence. Getting a panicked call from a user stating that a printer is no longer working, only to walk over to it and find that it's simply out of paper, is both time-consuming and frustrating. Novell is now addressing this dilemma with its \$49.95-per-site Novell Distributed Print Services (NDPS), the result of a joint development effort with Hewlett-Packard Co. and Xerox Corp.

NDPS, which will be included in new versions of IntranetWare, essentially combines the functions of the printer, print queue, print server, and spooler into a single object and lets you manage all this with one utility. In addition, you can install and configure all your printers from a single location using the NetWare Administrator utility and make them available to all the users on the network. NDPS is also tied into NDS, so you have strong security and centralized management. The drawbacks are a somewhat difficult installation, a long wait for truly NDPS-compliant printers to come to market, the lack of client software for Windows NT, and the dearth of the necessary gateway NLMs that allow NDPS to communicate with the printers. But with its low price tag, you can try it now and wait for the coming perks.

NDPS comes with client and server software. The client software is available for Windows 3.x and Windows 95. The server soft-

ware has to be installed on a NetWare 4.1x server, and you need the latest service pack from Novell, which is included on the NPDS CD. Our installation was tough. For some unknown reason, we had to install the software three times before it would successfully create our NDPS NDS objects. Typically, though, total installation of the software and printer drivers should take only about 20 minutes.

NPDS works by creating a single NDS object called an agent, which represents a single printer attached in your network to a file server via a parallel or serial connection or a direct LAN link. The agent then communicates with an NLM called the broker. The broker provides notification, advertises available printers, and stores

printer drivers. The broker also prevents the need for Service Advertisement Protocol (SAP) packets to be sent constantly to all of your network printers. This feature alone can greatly reduce unwanted network traffic.

To communicate with the printer, NDPS currently uses an NLM called a gateway, which translates proprietary printer protocols into NDPS information. For example, the Hewlett-Packard gateway can communicate with any printer with a JetDirect card installed and provide information such as the amount of toner in the printer, the existence of a paper jam, or other problems. Currently, NDPS ships only with Hewlett-Packard and Novell gateways, but offerings from other vendors should soon follow.

NDPS also includes Printer

Manager, which runs on the clients, and a notification utility. Printer Manager lets you see, monitor, and select available printers. For example, you can search for a printer in accounting that provides color on legal-size paper. After finding the printer, Print Manager will automatically download the drivers to your client PC so you can print using it. The notification utility lets you configure NDPS to alert you about problems, such as a paper jam or a printer that is out of paper, and when a job is completed. The notifications can be sent to a pop-up screen, e-mail, or if you have GroupWise, a pager.

NDPS. List price: \$49.95 per site. Novell Inc., Orem, UT; 801-228-5020; fax, 801-228-5077; www.novell.com. Circle 534 on reader service card.

NETWORK MANAGEMENT

SNMP Info from Anywhere

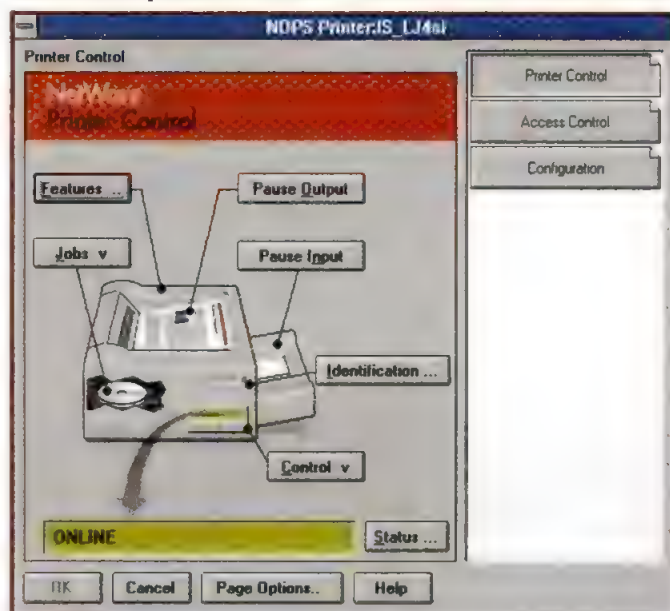
By Steve Rigney

Options for managing SNMP-based devices, such as bridges, routers, and servers, have been few and far between. In the past, you could use either a dumb-terminal connec-

tion, which wasn't centralized and required you to travel to your devices, or high-priced SNMP utilities. But the ubiquity of the Web coupled with new, inexpensive management software from vendors such as Asanté and Wipro offers you an alternative solution.

In this roundup, we look at Wipro's CyberManage and Asanté's IntraSpec. Each uses a centralized piece of software running on a server to gather data from the network devices' MIBs, presents the data in an HTML format, and lets you use any Java-capable Web browser to view the information.

CyberManage and IntraSpec each cover all the standard network MIBs and provide real-time statistics. IntraSpec's optional modules for managing specific devices (down to the port level) make it seem more powerful, but if you don't mind writing your own device modules, CyberManage can provide most of the same functionality found in IntraSpec.



IN NDPS, the printer gateways allow you to monitor and control detailed information about the printer.

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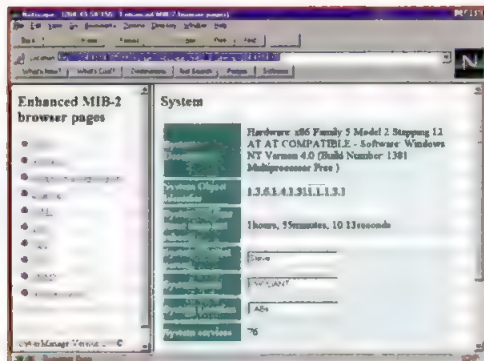
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CyberManage

Yet another example of Java in action, CyberManage (\$399 list) from Wipro lets you view and manage all SNMP-based devices on your network via a Java-enabled Web browser. It provides excellent real-time graphing, device displays, and views of your network's topolo-



CYBERMANAGE lets the administrator drill down to inspect individual network devices.

gy. Unlike IntraSpec, CyberManage doesn't provide modules for specific devices, but the free CyberKit lets you write your own with almost the same amount of functionality.

Since CyberManage is based completely on Java (as compared with IntraSpec, which uses only a few Java applets), you need to install the Java Developers Kit 1.0.2 or later (free download available at java.sun.com) on your CyberManage server. In general, we found the product easy to install, which is important because detailed configuration instructions are lacking. But the online help system should answer all your questions. A useful feature is the ability to configure multiple subnets with different IP address ranges.

When we first connected to the CyberManage server, the software asked us to run a discovery utility to find the SNMP devices on our network. All we had to do was enter the IP address and subnet mask of our network, and the software did the rest.

The Global View lets you see the topology of your network

and the devices connected to it. The first screen shows your subnets, and the subsequent screens let you drill down to individual devices. This tiered approach differs from IntraSpec's basic table of devices and provides more information about where the devices reside on your networks.

If you happen to be using CyberManage behind a firewall that doesn't pass Java applets, you can use the SnapShot view to see the devices on the network. Unlike the Global View, the SnapShot doesn't provide topographical information on the devices, but like IntraSpec, it does allow you to see the state of each

device and information about it. CyberManage doesn't provide as many images as IntraSpec, but it does include the most common devices.

We found CyberManage's free separate CyberKit utility outstanding. Like IntraSpec's Personality Modules, CyberKit lets you gather detailed information about a specific device. CyberKit requires you to edit some fields, but unlike the Personality Modules, it doesn't limit you to devices for which the vendor writes a module.

The Event Notification utility sends an e-mail, fax, or page if a threshold or SNMP trap occurs. The software works with any MAPI-compliant message system, such as Microsoft Exchange, to send a message when something happens. IntraSpec doesn't provide notification or alerts to the network administrator except for a message on the management console screen.

CyberManage. List price: \$399. Wipro Ltd., Cupertino, CA; 408-253-4460; fax, 408-253-5019; cybermanage.wipro.com. Circle 535 on reader service card.

Net Tools

FROM THE BENCH

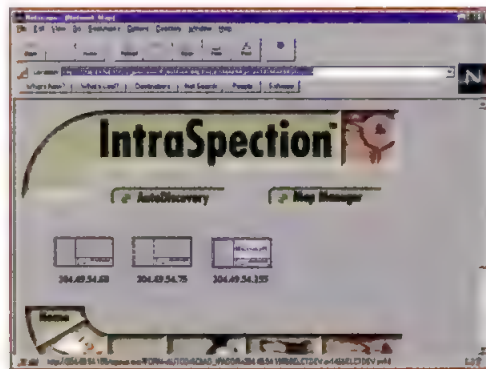
Asanté Technologies Inc.

IntraSpec

Holding the same promise as CyberManage, Asanté Technologies' IntraSpec 1.01 lets you manage all the SNMP devices on your network via the Web. Less expensive than CyberManage, IntraSpec (\$295 list) has the added benefit of its Personality Modules, which let you obtain in-depth management information. You have to pay from \$99 to \$199 per module, however.

If you don't mind skipping the product's documentation, you can download IntraSpec for free. The product's biggest drawbacks are that it currently works with only a single Class C IP network (a maximum of 255 devices) and doesn't provide SNMP trap notification.

IntraSpec runs as an application, not as a service, on your Windows NT 3.51 or 4.0 server. The product works with any Web server that supports CGI, such as Microsoft's Inter-



INTRASPEC will autodiscover all of the SNMP network devices within a given IP address range.

net Information Server. We found installation extremely easy. The manual had a few mistakes, such as misspelling the name of the installation utility, so you should peruse the readme file.

After installing the software, you can go to any PC with a browser, type in the IP address of

the IntraSpec server, and see the main menu. AutoDiscovery, the first task we ran, found the SNMP-based devices on the network. All we had to do was provide the IP address range we wanted to search. When it completed AutoDiscovery, IntraSpec displayed all the SNMP devices. Unlike HP's OpenView, it displays the devices in a columnar display, not a graphical one.

The IntraSpec Network Map provides a graphical depiction of all of the devices on the network. Using the industry MIBs, we clicked on every device in the network and gathered basic information such as device identification, port activity, and version information.

We did like IntraSpec's Personality Modules, though as mentioned, they cost extra. Modules are currently available for AsantéFast 100 hubs, Bay Networks System 2000 hubs, and 3Com SuperStack II Switch 1000s. With the Personality Modules, you can view and configure proprietary MIB information in addition to standard public MIB data.

Every SNMP device generates a trap if it encounters an error

or reaches a pre-set threshold. This information is sent to the IntraSpec server and saved in an ODBC-compliant format. Unlike CyberManager, however, IntraSpec doesn't provide notification capabilities.

Other features, such as

password security and Secure Sockets Layer (SSL) connections to the server, make IntraSpec safe to use on your network.

IntraSpec 1.01. List price: \$295. Asanté Technologies Inc., San Jose, CA; 408-435-8388; fax, 408-432-7511; www.asante.com. Circle 536 on reader service card. PC

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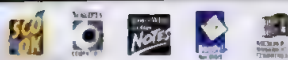
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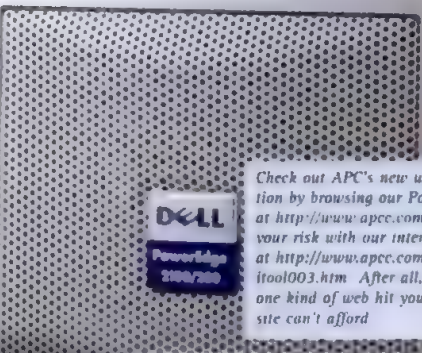
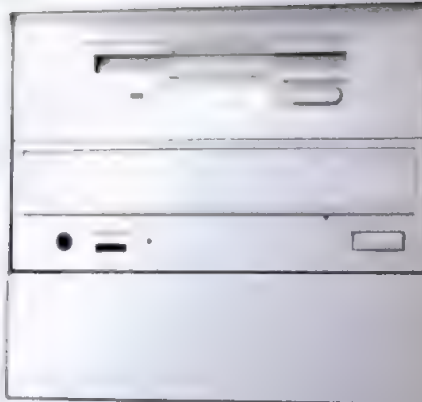


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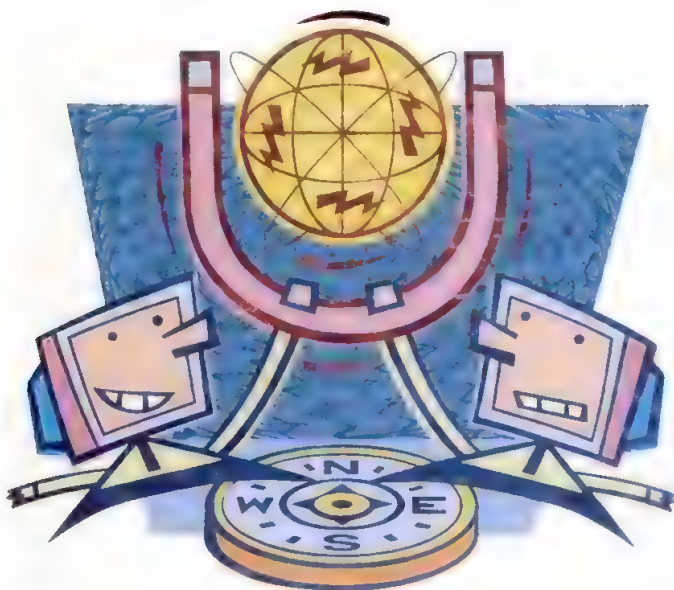
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Net Tools

INTERNET TOOLS

INTERNET TOOLS

Routing in Windows NT and IntranetWare



By Steve Rigney

Routing saves you money. It makes your networks more efficient and reduces the load on specific segments. Installing routing also costs money, but now that sophisticated routing capabilities come with Microsoft Windows NT and Novell's IntranetWare, you can install a router for much less than it cost when hardware routers from Bay Networks, Cisco, and other router vendors were the only games in town.

Software-based routers offer both flexibility and economy. The routing services in Windows NT (with Routing and Remote Access Service, or RRAS, free from the Microsoft Web site) and IntranetWare now work with the two most common routing protocols—Open Shortest Path First

(OSPF) and Routing Information Protocol (RIP) I and II. And you can use a low-end PC, such as a \$1,500 Pentium/133, to create a total routing solution for less than \$2,500. Compare that with the \$5,000 or more you'd need for a typical hardware solu-

tion. You can also simultaneously use the router PC for other server tasks, such as file, print, and fax services.

What you give up are some of the sophisticated reporting and management statistics you get with a typical hardware router. You also give up some space and reliability, since a PC requires more space than a 19-inch rack-mountable hardware router and has more components that can break. Furthermore, you need the skills to install and configure the PC's NOS, WAN interfaces, and routing software. But for most purposes, including linking to your ISP, the routers in Windows NT and IntranetWare are perfectly suitable.

WHY USE A ROUTER?

Routers are useful for more than connecting remote offices together and linking your network to your Internet Service Provider, although those are the most visible uses. One of the most common applications of a router is to segment your LAN, in order to decrease unnecessary traffic and increase performance. For example, if you have several network clients in your accounting department and several in your sales department, there is no reason why they should have to contend for the same LAN bandwidth. You can attach each department to a different network adapter in the server, and a router in the OS will keep the traffic separate while passing packets addressed between segments.

One useful feature of the rout-

ing available in Windows NT and IntranetWare is the ability to connect different network types. You can install a Token Ring and an Ethernet NIC in your Windows NT or IntranetWare server and use the routing software to route between them.

Routing software also appears in other devices, such as remote access servers. Every time you call your ISP, or dial into your office's remote-node server to retrieve a file, you are using a router. Except for remote-control-access servers, such as Citrix WinFrame and Symantec pcAnywhere, most access servers are basically dial-up routers.

WHICH ROUTER TO USE?

Most networks use the IP protocol for WAN connections because it carries data payloads efficiently, is ubiquitous, and doesn't generate the same redundant traffic as IPX. But if you are currently using IPX on your local LAN and need to route only between segments or two remote offices, IPX is probably the easiest solution. If you are using IPX, you probably have a NetWare or IntranetWare server, and it makes sense to use the router in IntranetWare, which has a long history of running IPX.

If you are using IP, you have a more difficult decision. Novell's router has been around longer, though Microsoft's RRAS has a more intuitive graphical interface, but neither router requires much maintenance once it's set up. In this case, it makes sense to use the

Destination	Network mask	Gateway	Interface	Metric	Protocol
127.0.0.0	255.0.0.0	127.0.0.1	Internal Loopback Interface	1	Local
204.40.38.0	255.255.255.0	204.40.38.5	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
204.40.38.0	255.255.255.0	204.40.38.5	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	2	OSPF
204.40.38.5	255.255.255.255	127.0.0.1	Internal Loopback Interface	1	Local
204.40.38.255	255.255.255.255	204.40.38.5	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
204.49.0.0	255.255.255.0	204.49.0.5	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
204.49.54.0	255.255.255.0	204.49.54.155	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
204.49.54.57	255.255.255.255	204.49.54.2	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
204.49.54.155	255.255.255.255	127.0.0.1	Internal Loopback Interface	1	Local
204.49.54.255	255.255.255.255	204.49.54.155	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
224.0.0.0	224.0.0.0	204.40.38.5	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
224.0.0.0	224.0.0.0	204.49.54.155	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
255.255.255.255	255.255.255.255	204.40.38.5	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local
255.255.255.255	255.255.255.255	204.49.54.155	[1] COMPAQ NetFlex/NetFlex-2 ENET-TR Controller	1	Local

A TYPICAL ROUTING TABLE from Microsoft Routing and Remote Access Service (RRAS) for Windows NT Server 4.0.

router in the NOS you are most familiar with.

HOW TO SET IT UP

The first thing you must do to use Windows NT's or IntranetWare's routing software is to configure the hardware. Judge your hardware requirements by the recommendations for each NOS. For example, IntranetWare will run

communicate with your ISP's router or with the other routers on your LAN or WAN. The most common inter-router protocols are RIP and OSPF. In a nutshell: If you want to route IPX or if any of the routers you need to connect with support only RIP, you have to use RIP. Keep in mind, however, that RIP has a 15-route limit—so it's appropriate only for smaller

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router is the broadcasts it makes. In order to keep the routing tables up to date, each router periodically transmits its entire routing table to all adjacent routers, which in turn transmit the information to their adjacent routers, and so on throughout the network. Though this alone is not a major detriment to network efficiency, the routers also transmit a route response packet every 30 seconds. All of this broadcasting can generate lots of traffic on the WAN and can even cause some routers to initiate a call on a dial-up circuit, like ISDN, just to pass the RIP packets. Special configurations prevent this, but they also prevent RIP from being passed over a WAN.

Note that the router included with Windows NT 4.0 works only with RIP I. If you want to use RIP II, you'll need to download Microsoft's RRAS. The download is free, and in addition to RIP II, you get an implementation of OSPF. IntranetWare works with both standards straight out of the box.

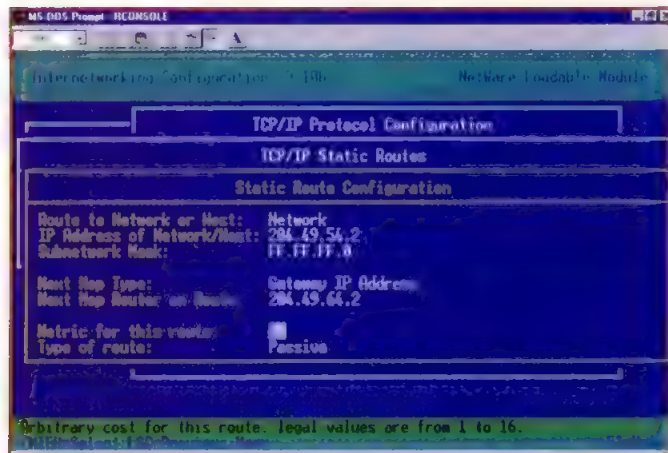
OSPF is a link-state routing protocol, which means that every router on the network keeps a map of the network layout and a table describing adjacent routers and their connections. OSPF was designed to improve on RIP by allowing more routers (up to 65,535) and creating less traffic on the network. Instead of broadcasting entire routing tables, OSPF routers broadcast only changes to adjacent routers using the Hello protocol, and those routers broadcast to their adjacent routers, until a new map of the network is built. Also, broadcasts happen only when a router is added or changed, further cutting down on unnecessary traffic. As its name implies, OSPF will

attempt to use the shortest connection to a site if you have multiple routed connections to that site. If the shortest connection is down or busy, OSPF will try the next shortest one, and so on. If your routers don't support broadcasts and the Hello protocol can't be sent or received, you will have to configure the routers manually with the connection information.

Unlike RIP, which uses the User Datagram Protocol to transport routing table information, OSPF operates directly above IP—resulting in a better guarantee of message delivery. Besides creating less broadcast traffic, OSPF works well with larger intranets that include WAN links.

Once you choose your protocol, the next step—which is optional—is to input cost information for all your static routes. If you're merely setting up the router for a single connection to an ISP, there's no need to change the default cost information.

Once the router is configured, it will find the other routers on the network to build its routing tables. From that point on, little maintenance is required. Hardware



SETTING UP STATIC ROUTES using RIP in IntranetWare: The metric, or cost, of a route is a number from 1 through 16, inclusive.

on a lowly 486-based PC; just remember to use at least 16MB of RAM for every 1GB of hard disk space. Likewise, Windows NT requires a Pentium-class PC with at least 32MB of RAM to be really satisfactory. You'll also need two interfaces, one to your local LAN and the other to your desired routing network. The second interface can consist of almost any connection type, including a network adapter, dial-up analog modem, ISDN modem, or leased line. Fortunately, there are several interface adapters that will work with the routers in Windows NT and IntranetWare, including products from Ariel, Cardinal, and Digi.

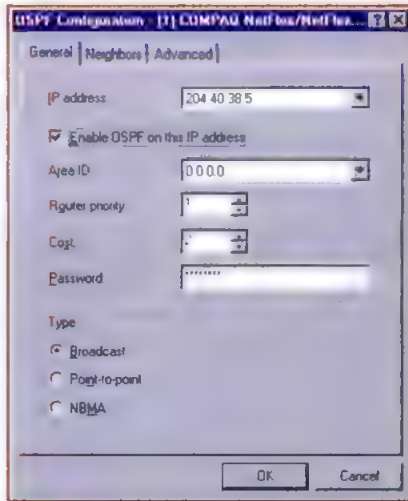
RIP AND OSPF

The next step is to configure the routing software that comes with the NOS. This is simply a matter of loading the routing services, configuring the network numbers (for IPX) or IP addresses (for IP) of the NICs in the routing computer, and choosing the inter-router protocol you want to use to

networks. Otherwise, especially on larger networks, OSPF is the way to go. Unlike RIP, OSPF works only over IP.

RIP is a distance-vector routing protocol, which means it represents routing information in terms of the cost of reaching each specified destination. By default, RIP defines cost as the number of router hops. Cost can be any number from 1 through 16. Administrators can assign each static route a different cost based on speed, service cost, or traffic volume. Assigning a high cost to a route tells the router to use that one last; a low cost tells the router to use that route first. Once you establish the route costs, the router stores this information in a RIP routing table. The routing table includes the IP addresses of all the possible destinations, the IP address of the next router in each destination path, and the cost of each route. RIP II is an enhanced version of RIP; its biggest advantage is sending the subnet information in the network packet.

The biggest drawback to a RIP



USING OSPF to configure static routes in Windows NT RRAS.

routers from Bay Networks, Cisco, and other vendors still have their place in the network, but making use of the routing services in Windows NT and IntranetWare can fulfill many of your routing needs for considerably fewer dollars. **PC**

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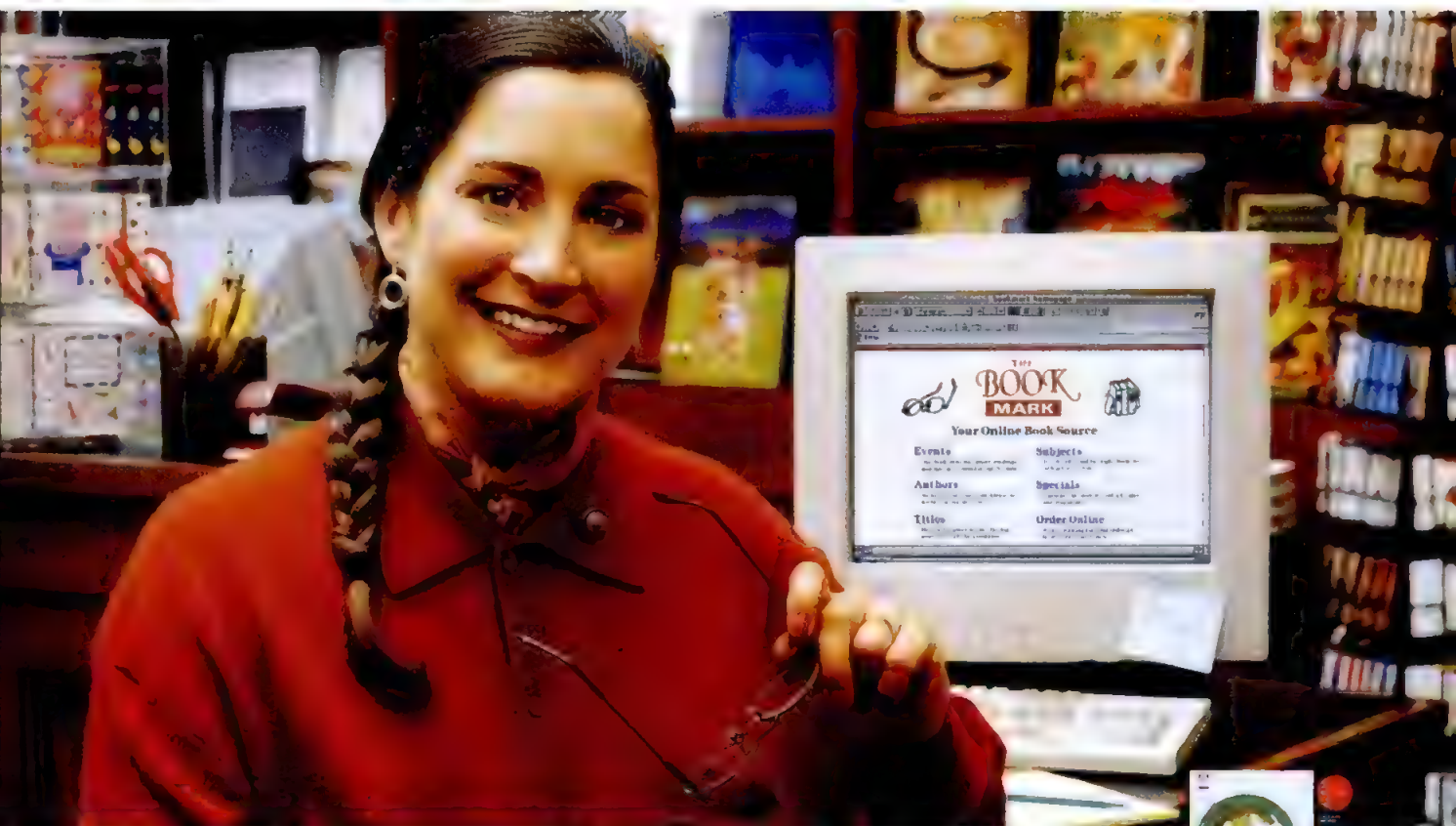
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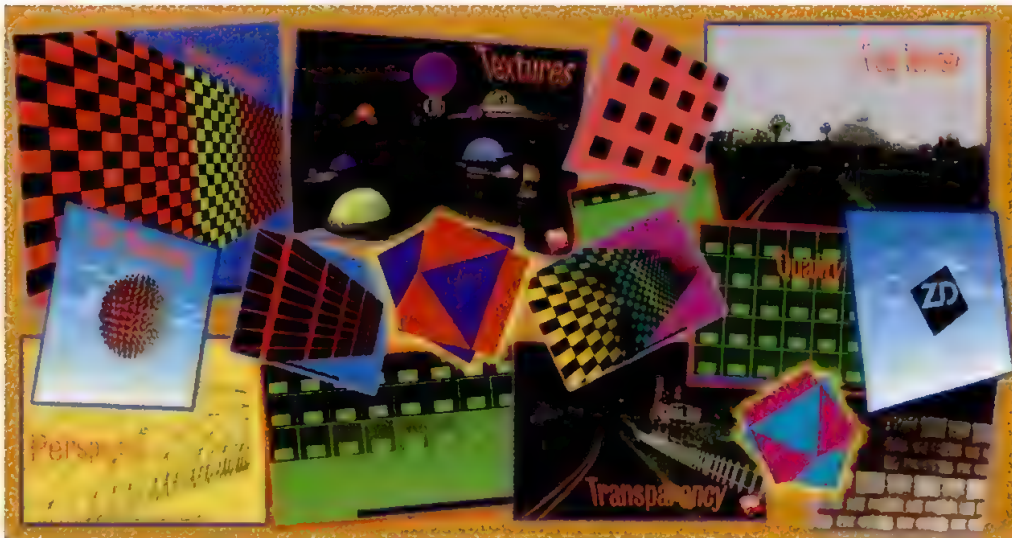


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PC Tech



Inside PC Labs' Latest Benchmark Tests

Advancing the state of the art: Winstone 98, WinBench 98, and 3D WinBench 98.

By Mark L. Van Name and Bill Catchings

With this issue's reviews of systems and graphics adapters ("The Best PCs for '97 and '98"), PC Magazine Labs introduces the newest versions of its industry-standard PC benchmark test programs: Winstone 98, Version 1.0; WinBench 98, Version 1.0; and 3D WinBench 98, Version 1.0. These testing tools reflect the changing nature of desktop computing, using more applications than ever before, with many new tests, and providing new features that improve the testing process and the analysis of results.

Despite their many new features, the names of these benchmark tests should sound familiar: They're the latest incarnations of the tools we've been using to evaluate PC performance. Like previous versions, they are the result of a year of development effort by the Ziff-Davis Benchmark Operation (ZDBOP), the research and development group that works with PC Labs and several Ziff-Davis publications to

create all our benchmark tests.

Winstone 98 uses scripts that utilize real applications to produce an overall measure of a PC's performance under Windows. It builds upon last year's version with more Business applications (including a Web browser), two task-switching tests, and additional High-End tests.

WinBench 98 acts as a subsystem-level companion to Winstone 98. WinBench 98 provides detailed information about the performance of all of a PC's major subsystems—processor/RAM, graphics, disk, CD-ROM, and full-motion video playback.

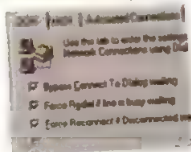
3D WinBench 98 addresses performance and rendering-quality issues raised by the latest set of 3-D graphics accelerators and systems. It measures 3-D graphics performance by using the Windows Direct3D API, Version 5.0, to render 3-D scenes similar to those in games. 3D WinBench 98 provides both an overall score, the 3D WinMark 98, and a wide variety of other 3-D performance test results.

All three benchmark programs offer many

INSIDE

TUTOR: Advanced CMOS settings can optimize system performance. Find out about settings for boot-up, shadowing, and power management. *Page 355.*

OPERATING SYSTEMS: Windows 95's Dial-up Networking is extremely popular but somewhat mysterious. Learn about how it handles passwords. *Page 365.*



POWER PROGRAMMING: We look at programming for Microsoft's newest and smallest OS, with emphasis on limited memory and the command bar. *Page 373.*



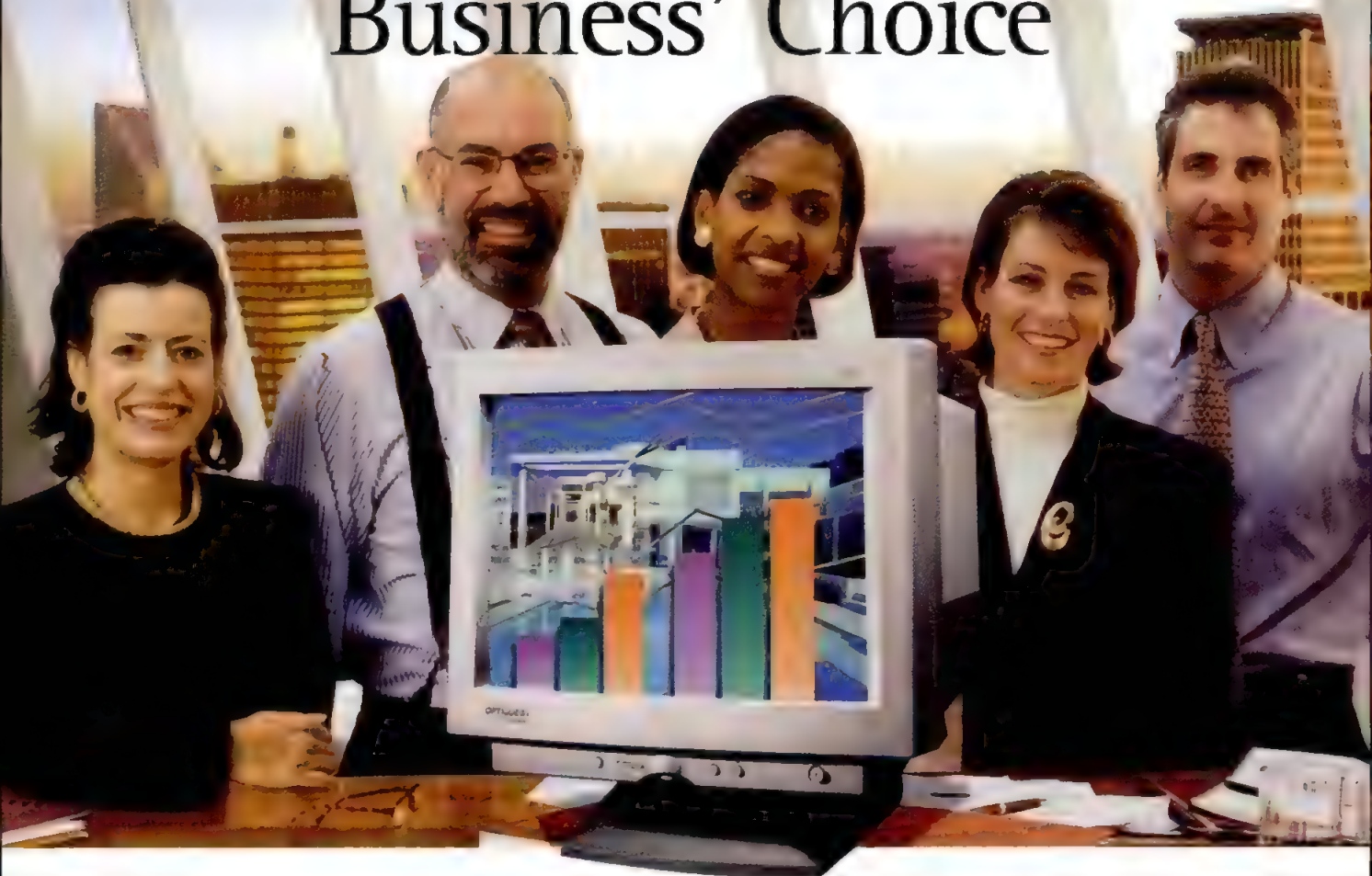
UTILITIES: WinTidy 95 neatens up the icons on your Windows 95 desktop, offering predefined arrangements. *Page 379.*



PC SOLUTIONS: Link your Internet Explorer Favorites list to your Start menu; publishing your own CD-ROMs; and more. *Page 431.*



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Because these applications address very different user communities, all seven have equal weight in the overall High-End score Winstone 98 produces.

Though most of these applications will run on Windows 95, the Winstone 98 High-End tests will run only on Windows NT. This reflects the way *PC Magazine* and other Ziff-Davis publications test systems.

Once a PC has completed the scripts, Winstone 98 produces its scores. The benchmark program times how long the PC takes to complete each script. It then converts each timing to a score relative to the time a base machine took to complete the same script. In Winstone 98, each overall score is relative to the overall score of the base machine, which we set to 10.0. The category scores and the individual High-End application scores are relative to a score of 1.0 on the same base machine.

The base machine was a 133-MHz Pentium Dell Dimension with 32MB of RAM and a screen resolution of 1,024 by 768 pixels at 16-bit color depth. The machine was running Windows NT 4.0 (Service Pack 3). Different parts of Winstone 98 do, however, have different system requirements:

- Microsoft Windows 95 or later or Windows NT 4.0 (build 1381) Service Pack 3 or later (to run the High-End tests, you must use Windows NT);
- 16MB of RAM to run Winstone 98 Business tests and 32MB of RAM to run Winstone 98 High-End tests;
- about 330MB of free disk space for a full installation; for working space during the tests, the hard disk also needs an additional 70MB of free space to run Winstone 98 Business tests or 140MB of disk space to run Winstone 98 High-End tests;
- a display with 256 or more colors (a Photoshop requirement) for the Photoshop test;
- TCP/IP loaded and a valid machine name for the FrontPage test (a network adapter is not required);
- 800-by-600 or higher resolution to run Winstone 98 Business or High-End tests.

As you might imagine from a test suite that involves so many applications, Winstone 98 is big. It contains more than 200MB of data, so it is available only on CD-ROM; online and floppy disk distributions are not options.

WINBENCH 98

The hard part in creating a benchmark program like WinBench 98 is making sure its tests really do act like the applications whose behavior they are supposed to reflect. WinBench 98 uses a proprietary Ziff-Davis

technology, Playback, to do this. Playback acts like a VCR, playing back previously recorded subsystem-level activities of the Winstone 98 applications. Unlike a VCR, however, WinBench 98 plays back the actual subsystem-level Windows calls the Winstone 98 ap-

plications made while executing the Winstone scripts.

WinBench 98 provides both Business and High-End versions of each of its familiar Graphics WinMark and Disk WinMark tests. WinBench 98 also continues to offer tests of the performance of a PC's processor/RAM, CD-ROM, DirectDraw, and full-motion video subsystems.

WinBench 98 produces Graphics scores corresponding to all the scores Winstone 98 produces and normalizes them to the same base machine. The Graphics WinMark score, however, is by no means the same as any of Winstone 98's scores. WinBench 98 produces the Graphics WinMark score by running a series of practically nonstop graphics stress tests, where the applications in Winstone 98 intersperse graphics, disk, and processor tasks.

The Disk WinMark score, like the Graphics WinMark score, comes in Business and High-End versions. WinBench 98's Disk WinMark 98 tests play back all the timed application disk activity in Winstone 98. In the course of their operations, the tests use many directories and hundreds of files, which touch approximately 200MB of disk space.

WinBench 98 also offers a processor sub-

system performance test: CPUmark₃₂. As you'd expect, CPUmark₃₂ is a 32-bit test that reflects the processor usage of 32-bit applications like those in Winstone 98.

You may find it tempting to try in some way to combine the CPUmark₃₂, Business Disk WinMark 98, and Business Graphics WinMark 98 results and equate the result with the Business Winstone 98 score. But that approach doesn't work. The way the subsystems interact is an important part of a system's performance, and Winstone 98 takes that into account in its overall score. The WinBench 98 scores, by contrast, focus on individual subsystems.

The CD-ROM WinMark 98 test plays back the CD-ROM operations of six leading CD-ROM applications in three areas: Business/Productivity, Games and Entertainment, and Reference and Education.

WinBench 98 lets you test video playback performance with a clip of a moving carousel that you can display with the Cinepak, Indeo, or MPEG codec. Finally, WinBench 98 includes a set of DirectDraw inspection tests.

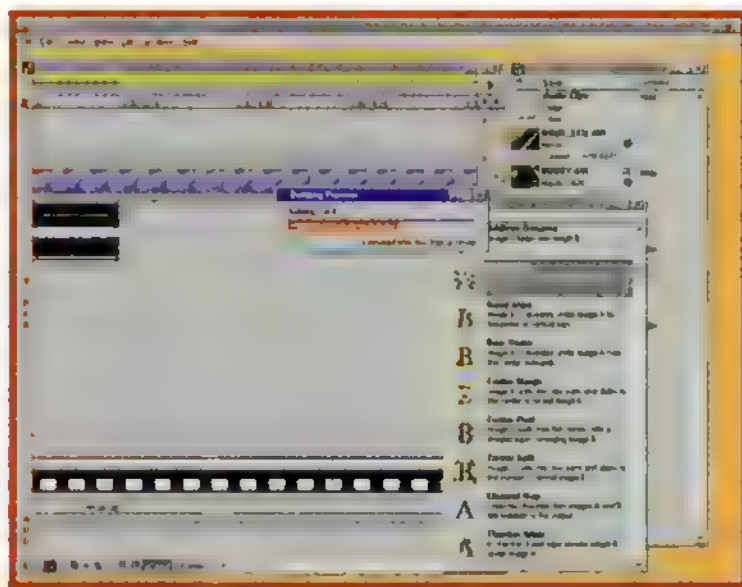
3D WINBENCH 98

One of the most important aspects of testing a 3-D accelerator is accurately determining which 3-D features that accelerator implements correctly. 3D WinBench 98 measures 3-D performance and helps you assess 3-D quality. Given the recent upsurge of 3-D technology on the PC and the influx of 3-D-capable graphics accelerators, we will provide a fairly detailed overview of 3D WinBench 98's capabilities.

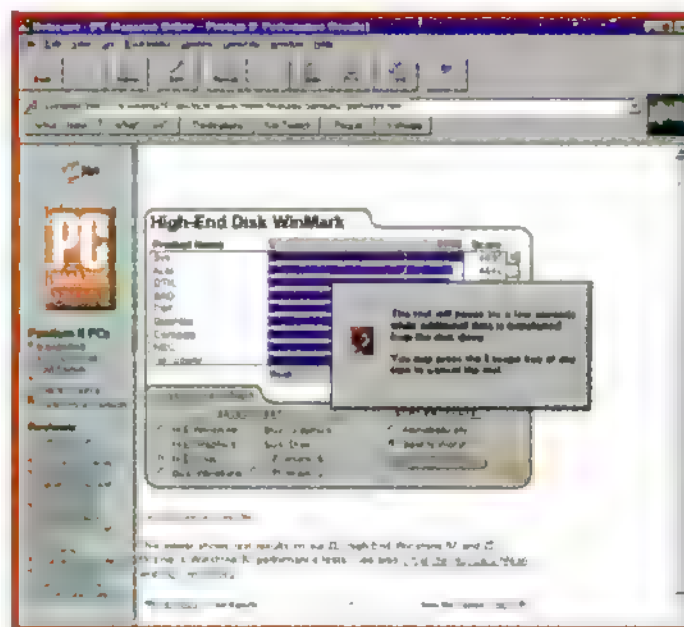
3D WinBench 98 attempts to determine which rendering features an accelerator and its driver support just as games do: by querying Direct3D. From this query, 3D WinBench 98 gets information on which 3-D features the accelerator claims to provide in hardware via the HAL (Hardware Abstraction Layer) and which require the software HEL (Hard-

ware Emulation Layer). This knowledge is vital and has huge performance implications, because the HEL, an entirely software-based system, is a great deal slower than the hardware-based HAL.

The design of Direct3D is such that if an



ADOBE PREMIERE, which here is preparing to display a video preview, is one of two new applications Winstone 98 includes in its High-End test suite.



HERE WINBENCH 98 pauses to read graphics information from disk as it plays back Netscape's graphics activity.



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accelerator does not support in hardware *all* the 3-D rendering options a scene employs, an application must display the entire scene using Direct3D's HEL. No application, including 3D WinBench 98, can choose to implement some of a scene's rendering options with the HAL and others with the HEL. It's all or nothing.

To help our testers—and you—accurately determine the rendering options of a 3-D accelerator, 3D WinBench 98 provides a very large 3-D quality verification suite. Each display in the suite shows you how a scene should appear if an accelerator implements the associated features correctly, and you can compare that image with the one the accelerator actually provides. If you decide an accelerator does not implement a feature correctly or adequately, the benchmark tests use the slower software HEL on all scenes using that feature. (The HEL is unable to render scenes that use some features, such as trilinear MIP mapping. In such cases, the benchmark tests don't display them either.) Direct3D 5.0 can render more via its HEL than earlier versions could, but 3D WinBench 98 still contains scenes Direct3D cannot render in the HEL.

The main score 3D WinBench 98 produces, the 3D WinMark 98, is a measure of both overall 3-D performance and rendering/quality options. The benchmark test program produces this score by displaying a series of 19 scenes, up from 10 in the previous version. These scenes exercise the 3-D subsystem the same way games do. Because most Windows 3-D games shipping or under development use Direct3D's Immediate Mode API, 3D WinBench 98 also uses that interface to render its test scenes.

Those scenes stress a variety of 3-D features. They vary in complexity—the number of triangles they draw in the course of displaying their images—and in the number of rendering or quality-enhancing options they employ. The complexity of the scenes employed by the 3D WinMark tests ranges from more than 2,000 triangles per frame to well over 6,000. This range represents the complexity levels of both today's games and those that will debut in the coming months.

In some scenes, the benchmark tests use only the minimal set of quality options most games consider necessary for decent appearance: point sampling, perspective correction,

How to Get Copies of the New Benchmark Tests

If you would like a copy of 3D WinBench 98, you can download it from the Ziff-Davis Benchmark Operation (ZDBOp) home page on the Web, www.zdbop.com. From the same place, you can also download a copy of WinBench 98, but the online version does not contain the graphics, CD-ROM, or video performance tests; those tests and the files they require are too large for downloading. Winstone 98, at more than 200MB in size, is also not available for downloading. To get those benchmark programs, you will need to order the CD-ROMs that contain them.

The three PC benchmark programs come on two CD-ROMs. One CD-ROM contains complete versions of Winstone 98 and 3D WinBench 98. The other contains the complete version of WinBench 98. ZDBOp will mail you a copy of either CD-ROM for a shipping and handling fee of \$5 (in Canada, \$6; elsewhere outside the U.S., \$7). Additional CDs are \$1, so you can have all three benchmark programs for \$6 (in Canada, \$7; elsewhere outside the U.S., \$8). To order the CDs, use the order form on the ZDBOp home page or fax your request to 919-380-2879. You can also mail an order to the following address:

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and Z-buffering. In other scenes, the tests apply more powerful—and more demanding—quality options, such as bilinear filtering, fog, specular highlighting, and MIP mapping. New additions in this year's version are anti-aliasing, trilinear MIP mapping, and different

flavors of alpha blending. As we write this, no accelerator currently available implements all of these features, but each one can be done correctly by at least one card.

Most of the scenes fit into the video memory of most accelerators, but a couple use almost 6MB of textures.

For standard 4MB

most of the scenes, like most games, fit fine in 4MB, the benefit may not be too large.

Higher 3D WinMark 98 scores are better than lower scores, but the scores don't have a simple linear relationship. An adapter scoring 100 is significantly better than one scoring 50, but the gap results from more than just speed differences. Think of the score as a measure of overall 3-D ability, rather than simply as a frames-per-second performance metric.

By default, the 3D WinMark 98 scores are based on 640-by-480 resolution and 16-bit color depth. Most reviews in *PC Magazine* and other publications use this setting, especially for accelerators with 4MB of RAM (2MB cards no longer work with 3D WinBench). 3D WinBench 98 lets you test at higher resolutions and bit depths.

THE FUTURE

We're already working on next year's benchmark tests, which will have to deal with ever faster processors and components as well as with the upcoming versions of Windows, Windows NT, and Direct3D. Watch for them! **20**

Mark L. Van Name is vice president of product testing for Ziff-Davis Inc. Bill Catchings is director of the Ziff-Davis Benchmark Operation, a research and development division of Ziff-Davis.



3D WINBENCH 98's improved Quality Suite lets you compare good and bad images against images the card being tested has produced.

cards, 3D WinBench swaps the textures between system memory and video memory. The swapping algorithm is a very good one, but any swapping slows performance. Cards with more video memory do not have to pay as much of a swapping penalty. Accelerators that can use system memory directly for textures, such as AGP (accelerated graphics port) cards and some PCI cards, also avoid swapping. Consequently, more video memory and AGP deliver some benefit. But since



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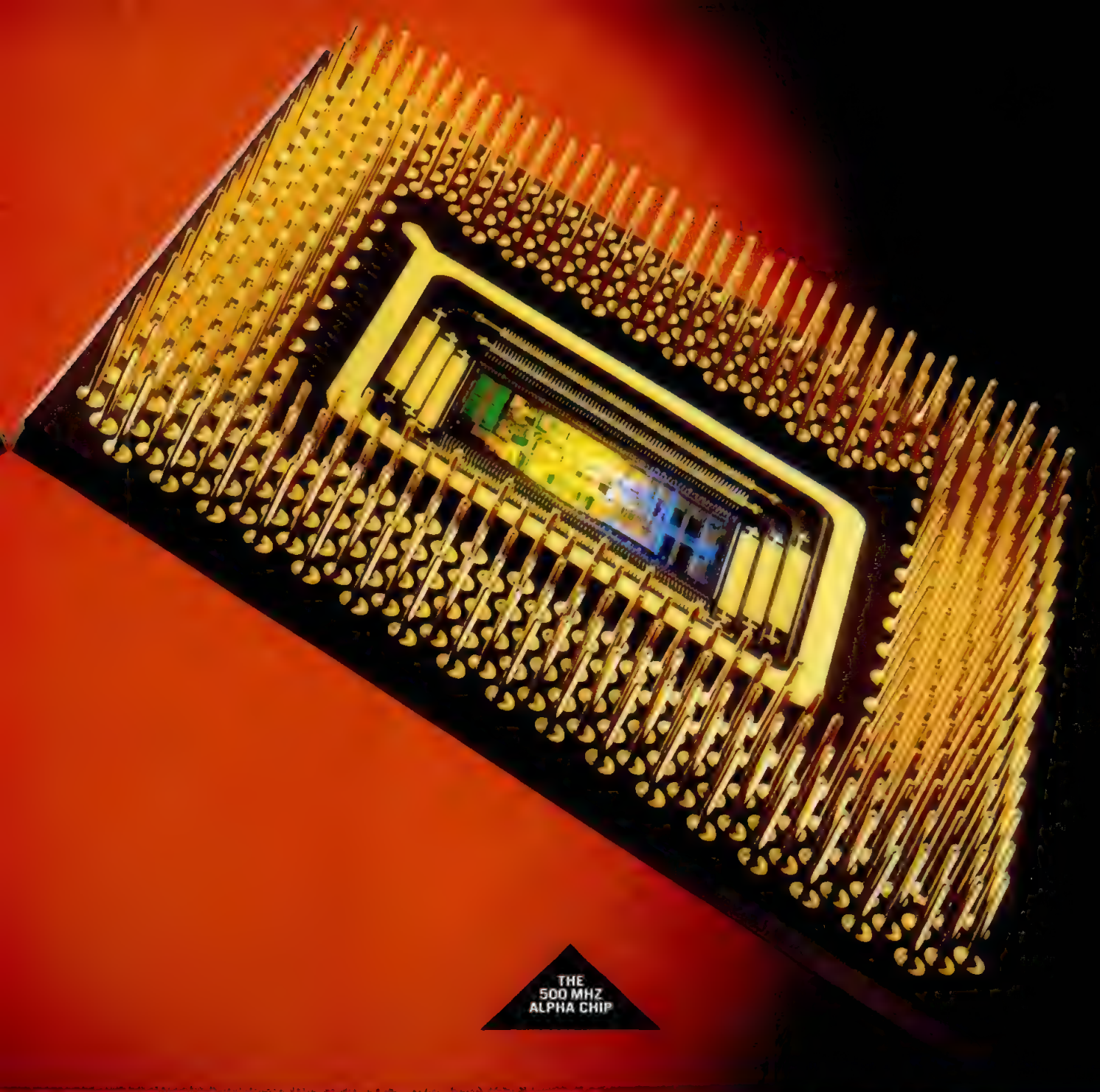
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Uncovering the Power of Advanced CMOS Settings

We finish our two-part series on CMOS by revealing how to improve system performance by adjusting the settings.

By Neil Randall

None can dispute that CMOS is vital to your PC. We demonstrated this in issue 19's Tutor column, when we examined the relationship between your computer's CMOS and BIOS and looked at the standard settings in CMOS. This time, we'll explore the various advanced CMOS settings. Unlike the standard settings, several of the advanced CMOS settings can be adjusted to improve your system's performance, and we'll look at these possibilities as well.

The CMOS setup on your computer may differ from those that we discuss here. Different BIOS makers offer different options, and their CMOS setup programs group these options into various categories. For the most part, however, the similarities will outweigh the differences. If you find an option not listed here, use your CMOS setup program's help menu to see what the option does. If you're still not sure, try visiting the Web site of your motherboard or BIOS maker.

Be aware that changing your CMOS settings can prevent your computer from starting up properly. If your machine does not boot, try entering CMOS again—usually it will get this far—and select the default settings (or whatever name that option bears). If that fails, try powering down the computer, then holding down the Del key while you power it back up. This should bypass the BIOS options and allow your machine to start. If that fails, call your dealer. The real trick is to change only one option at a time, then save the CMOS settings and reboot the machine to see whether your system behaves any differently.

PROCESSORS, TESTS, AND MEMORY

These options are typically subsumed under a setup area labeled *Advanced Options*, or something similar. On your computer, they might be split into two or more categories. Note that in the recommendation for each feature, the terms *On* and *Off* are usually used. On some BIOSes, *On* and *Off* correspond to *Enabled* and *Disabled*, respectively.

- **Above 1MB Memory Test:** The BIOS checks system memory for errors or malfunctions. It checks the first megabyte automatically, but it

will check all your memory if you tell it to. This seems like a good idea, except that DOS and Windows offer their own verification through system drivers, so the BIOS check is unnecessary—especially since it slows boot time by several seconds. Turn it off for better boot-up speed, but toggle it on if you're finding small, inexplicable errors in your applications. (This option is called *Quick Boot* in some BIOSes, in which case the recommendation should read *On*.) Recommendation: *Off*.

- **Memory-Test Tick Sound:** This is the clicking sound that accompanies the memory count at boot time. Turn it off if it annoys you. Leave it on if you want an audible confirmation that your system memory is working well. Recommendation: *Off*.

- **System-Boot Number Lock:** By default,

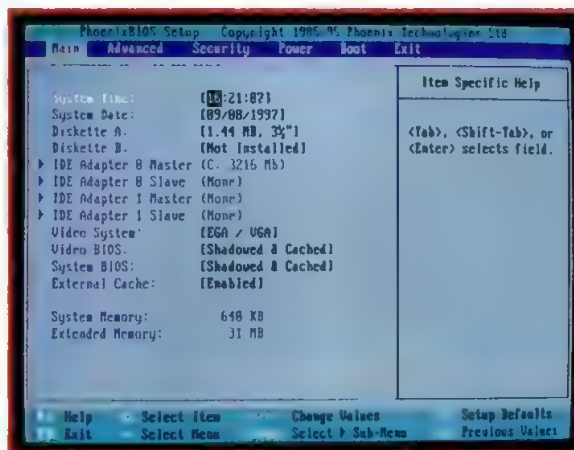


FIGURE 1: This is the Phoenix setup screen. The settings on your CMOS setup may vary slightly or be in different categories.

most PCs boot with the Num Lock key turned on. If you don't need this (and many users don't), you can toggle it off from CMOS setup. Recommendation: User preference.

- **Wait for F1 on Error:** By default, if your system encounters a nonfatal error (one that will still allow the operating system to start) at boot time, everything will halt until you press the F1 key. Toggle this feature off if you want to start a machine that doesn't have a keyboard, or if you just want to take your chances. Recommendation: *On*.
- **Typematic Rate:** The typematic rate, ex-

pressed in characters per second, is the rate at which a key repeats (how many times it prints to the screen in a second) if you hold it down. You can set the rate to suit your preference—the choice is simply *Fast* or *Slow* on some BIOSes—but usually your system default will suffice. The typematic rate can also be set through the Control Panel in Windows. Recommendation: System default.

- **Typematic Rate Delay:** This is the length of time between when you hold a key down and when it will begin to auto-repeat. If you have heavy fingers or a disability that makes it difficult to lift your fingers quickly off the keys, set this to a higher value. The typical value is 500 nanoseconds or so, but you should experiment with it. This delay can also be set through the Windows Control Panel. Recommendation: System default.

- **Numeric Processor Test:** If your processor contains a math coprocessor, this setting should be toggled on. All 486DX and faster processors have math coprocessors built in, so on most systems this option will automatically be enabled. If you have a 486SX or slower processor and you add a math coprocessor, be sure to toggle the setting on. Recommendation: Depends on processor.

- **Weitek Coprocessor:** Some 386 motherboards shipped with Weitek math coprocessors. These are faster than most coprocessors, because they use system RAM, and that requires an allocation of address space. Toggle the setting on only if you have this coprocessor. Recommendation: *Off*.

- **Floppy Disk Drive Seek at Boot:** By default, most systems will look for floppy disk drives when they boot. That's because operating systems used to load from floppies, and the system had to recognize the drive before it could be loaded.

Floppy disk drives are rarely used to boot computers anymore, so there's little need for your system to perform this search. Recommendation: *Off*.

- **System Boot Sequence:** This setting tells the BIOS on which drive to find the operating system. The standard sequence used to be A:, C:—this meant that the BIOS would check the floppy disk drive first. Then, if a floppy disk wasn't present, it would look to the primary hard disk for the operating system. This sequence is the reason your boot-up halts if you leave a nonbootable floppy in the drive. If you're sure you won't need to boot from

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floppies, choose the sequence C:, A: instead; this speeds the boot sequence, because the floppy disk drive isn't checked. This is not recommended for users who don't know anything about CMOS setup, however; the sequence C:, A: often hangs after a failure to find the operating system on C:, which means the user can't just slip a bootable floppy into the drive and keep going. You have to reboot. Newer BIOSes let you specify a CD-ROM drive in the boot sequence as well, for systems (such as Windows NT Server 4.0) that ship with their operating systems on bootable compact disks. Recommendation: C:, A: for experienced users.

- **External/Internal Cache Memory:** The external memory (or L2 cache memory) setting refers to the high-speed RAM that speeds data transfer between the processor and main memory. All current systems ship with L2 cache memory, and this setting should always be enabled. If you notice that your machine is lethargic, check to make sure that the L2 cache memory setting hasn't automatically switched itself off, as may happen during failed memory checks at start-up. The internal cache memory, or L1 cache, is located on the processor itself and should be turned on if your machine has a 486 or faster processor. These settings are listed separately on some BIOSes.

On recent BIOSes, you can also specify that each cache use the WriteBack or WriteThru caching algorithm; the former is the default, and the latter (which is slightly faster) should be used only if you are unafraid of a possible (but unlikely) loss of data should the PC's power go down.

Recommendation: *On* for cache, *WriteThru* for type.

- **Hit DEL Message Display:** Each BIOS offers its own key combination for entering the CMOS setup utility during the boot sequence. This option lets you enable or disable the message that appears on-screen telling the user what key to press. Toggle it off if you don't want users even knowing that CMOS setup is possible. Recommendation: *On*.

- **Turbo Switch:** If your PC has a turbo switch, allowing you to switch from the current blazing speed of your processor to the very slow speed of the first PCs (8 MHz) for the sake of compatibility with old software, you can choose to have the BIOS control the switch's function. Recommendation: *On*.

SHADOWING

Shadowing refers to the copying of ROM-based memory from the BIOS or from peripheral devices (such as video cards or network cards) into the same addresses in main RAM. In some cases, you can specify that the shadow be cacheable (in other words, able to be

copied into main RAM and accessible via the L2 cache). Since RAM is about three times as fast as ROM, successful shadowing improves system performance, and the even faster cache RAM further aids performance. But you have to experiment carefully with shadowing to avoid conflicts with hardware trying to use the same memory addresses as the shadow. For this reason, you should change these settings one at a time, rebooting each time to see that everything still works properly. If there's a problem, reenter your CMOS setup program and reverse the last adjustment, then reboot and try another. Generally speaking, shadowing on PCs works well only with DOS and Windows systems; it doesn't work with PC-based Unix systems such as Linux.

These options usually have three settings.

You have to experiment carefully with shadowing to avoid conflicts with hardware trying to use the same memory addresses as the shadow.

Disabled means that shadowing will not occur and there's no chance of address conflicts. This is the safest setting, but it does nothing to enhance performance. *Shadow* enables shadowing into main RAM but does not make this address cacheable. *Cache* both shadows the ROM into main RAM and allows it to be cached. By default, all shadowing is disabled and must be toggled on through the CMOS setup utility.

- **System BIOS Shadow Cacheable** (also called *System ROM Shadow F000*): This option lets you copy the F000h address segment of system memory (that of the BIOS itself) from slower ROM to faster L2 cache RAM. This provides the fastest possible access by the CPU to the BIOS. Recommendation: *On*.

- **Video ROM Shadow C000:** The BIOS area between memory addresses C000h and C8000h, which is reserved for the EGA/VGA BIOS, can be shadowed and made cacheable with this option toggled on. Recommendation: *On* (but test to make sure your video works).

Depending on your BIOS, you may be offered several other shadowing opportunities. These will come under headings such as *C400 Shadow 16K*, *D800 Shadow*, *Adapter ROM Shadow E800*, and so on. By default, these are disabled, and you should check with your peripheral manufacturer to see whether

shadowing them is a good idea. D000, for example, is a typical setting for network cards, and shadowing this area makes a lot of sense in a busy LAN. But it makes no sense at all if shadowing the memory area will result in more than one device competing for the same address. Often, experimenting—one setting at a time—is the only way to determine success.

POWER MANAGEMENT OPTIONS

Although power management on desktop computers is nowhere near as efficient as it is on notebooks, most recent PC BIOSes allow you to adjust certain power settings. The primary idea behind this is to cut power to specific devices when they're not in use. A secondary purpose is to "wake up" the machine when other devices are activated. You can set your fax machine so that an incoming fax call powers on the computer, allowing the fax modem to receive the call.

At this stage in PC development, each BIOS (and motherboard) has its own unique power management options. Here, we'll cover some of the choices seen on the majority of BIOSes. The labels here come from the American Megatrends BIOS (AMIBIOS).

- **Full-On-to-Standby Time-Out** and **Standby-to-Suspend Time-Out:** Computers capable of power management typically have three modes: Full-On, Standby, and Suspend. Full-On means that all devices are powered on at all times, whereas Suspend means that only a minimal amount of power is reaching the system, just enough to stop it from shutting down completely. A system in Standby mode powers back up more quickly than a system in Suspend mode. You can set the length of time the machine can sit inactive before switching to a lower-powered mode. Generally, you can set each such switch in 1-minute increments up to a maximum of 15 minutes, although various BIOSes offer various settings. Setting both time-outs to 10 minutes, for example, means that after 10 minutes of system inactivity, the system will switch from Full-On to Standby mode; then, after another 10 minutes, it will switch to Suspend mode. In each case, pressing any key will switch the machine back to Full-On mode. Recommendation: 15 minutes for both (experiment for your own preferences).

- **Hard Disk Power-Down Mode** and **Hard Disk Time-Out:** Because decreasing the power to the hard disk results in such a long delay when powering back up (you can wait several seconds for a hard disk to respond to the first request from the operating system), controlling power to the hard disk is separate from controlling power to the computer as a whole. You can set the hard disk to power down to Standby or Suspend mode when in-

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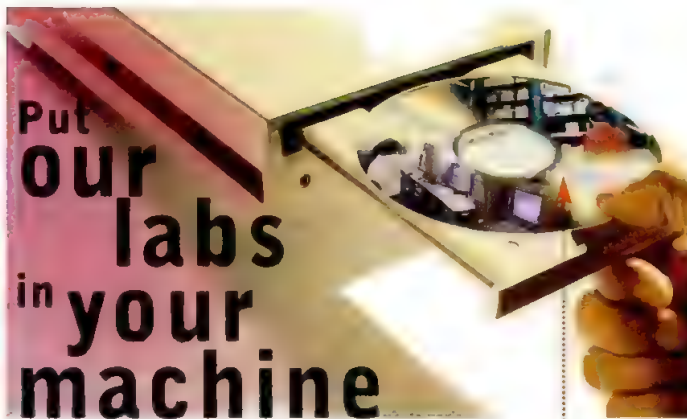


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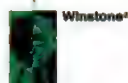
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activity reaches the number of minutes specified in the hard disk time-out option. In other words, it's possible for the computer as a whole to switch to Suspend mode while the hard disk remains in Standby mode. Such a setting would result in a faster return to full power. Recommendation: *Standby*, at the maximum time-out setting.

IRQ 3 through IRQ 15: Each IRQ setting can be monitored individually to determine when an event occurs that requires it. When the event occurs while the computer is in Standby or Suspend mode, an event on the monitored IRQ will switch the computer to Full-On mode automatically. An example would be a fax modem set at IRQ 3 that receives an incoming fax call while the computer is in Suspend mode. Without this option, the computer would need to be set to Full-On at all times in order to receive faxes. Recommendation: *Off*, except for specific devices as required.

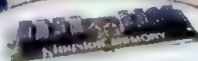
OTHER SETTINGS

Depending on your BIOS, you'll have a range of possible settings in addition to those discussed here. PCI-based motherboards typically offer an entire section on PCI settings, including enabling or disabling PCI Burst Mode (for performance boosts) and settings for an off-board PCI IDE card (one not found on the motherboard itself). You may also be able to set the BIOS to be aware of plug-and-play capability, in order to assist your operating system (Windows 95 in particular) in recognizing peripheral cards. Other peripheral settings are handled in the CMOS setup program either through the Advanced CMOS Settings menu or a separate Peripheral Setup menu. These include Parallel Port Mode (you have four choices: normal, bidirectional, Enhanced Parallel Port, and Extended Capabilities Port, with the choice depending mostly on your printer) and toggling on or off the floppy disk drive and serial port controllers on the motherboard. Finally, the CMOS setup utility may offer options for establishing system passwords; use these if you want to ensure that you're the only person who can boot the machine.

The trick to using the CMOS setup program is to change one setting at a time until everything is working optimally, and then to write down all the settings in case you have to set them from scratch later. Most of the time, your system will arrive from the dealer with perfectly functional CMOS settings already in place, but if you want full control over your system's performance, you owe it to yourself to master your CMOS setup program. **PC**

Neil Randall is a frequent contributor to PC Magazine.

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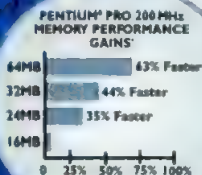
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Solving the Mysterious Save Password Problem

What to do when the Save Password feature in Windows 95's Dial-Up Networking won't work.

By Sal Ricciardi

The Dial-Up Networking (DUN) component of Microsoft Windows 95 is one of the operating system's most oft-used features, and it has its fair share of mystery and intrigue. That is especially true if you've been trying to understand why you can't get the Save Password feature in the Connect To dialog to work. This is a common problem that is often difficult to correct short of uninstalling and reinstalling a lot of software. There are a number of possible causes and recommended fixes, so solving the problem involves working your way down the list of possible fixes until you find one that works.

The Save Password problem concerns a feature in Windows 95 called password caching. By default, Windows 95 caches or saves your DUN passwords in an encrypted format in the <Username>.pwl password list file in your Windows directory. The <Username> portion of the filename normally consists of the first eight characters of your user name. For example, Johnsmith.pwl would be the filename for the file containing John Smith's password.

When you enter your user name and password and successfully log on to Windows, your password list file (hereafter "password file") is unlocked and made available. In particular, Windows associates your log-on user name and password with the passwords in your password file. From then on, whenever you try to use a password-protected resource, Windows looks for a matching password for that resource in the password file and supplies the password if it finds a match. It's when this caching mechanism becomes disabled or broken that the Save Password feature stops working.

To save your password in the password file, you check the *Save Password* check box in the dialog in question, such as the Connect To dialog used by Windows 95's Dial-Up Networking. (Figure 1 shows a Connect To dialog.)

In case you'd like to see what you have in your password file, Microsoft provides a password file editor that lets you view the resources stored therein. You can't view the passwords, but you can remove specific entries if you encounter problems using a partic-

ular password. The file Pwledit.exe is located in the Admin\Apptools\Pwledit folder on your Windows 95 installation CD. To install it, select the Start menu, select *Settings*, select *Control Panel*, double-click on the Add/Remove Programs icon, select the *Windows Setup* tab, choose *Have Disk*, and type <cd-rom drive>:\admin\apptools\pwledit, where <cd-rom drive> is the drive letter of the CD-ROM drive containing the Windows 95 installation CD-ROM. Next, select *Password List Editor* and choose *Install*.

The Save Password problem usually emerges in the form of one of two troublesome symptoms: Either you can check *Save Password* but it doesn't seem to save anything, or you can't check *Save Password* at all, because it's grayed out and therefore unavailable. Here's a list of things to do to try to correct the problem. After trying each one, check

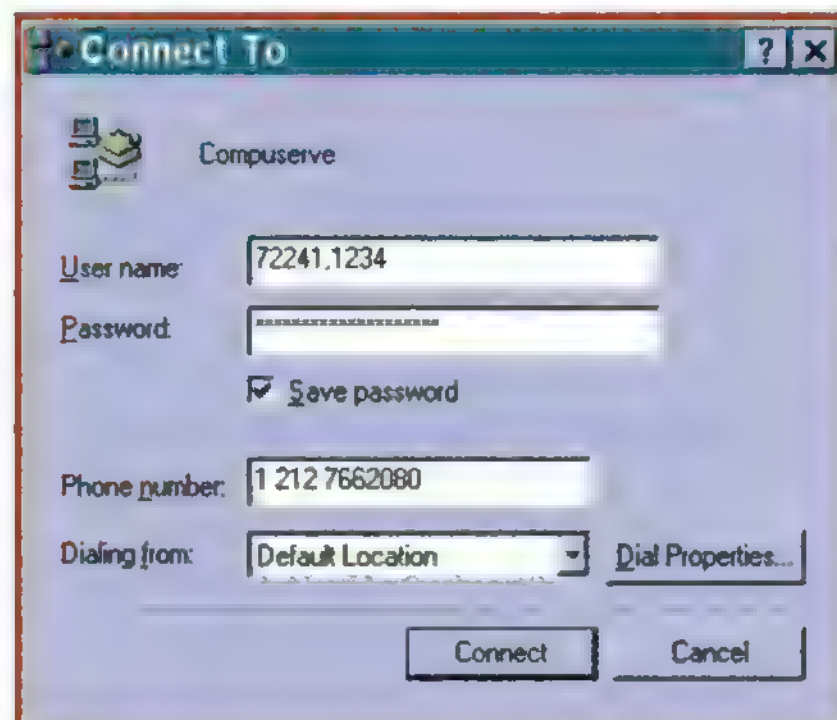


FIGURE 1: You use Dial-Up Networking's Connect To dialog to connect to service providers. If you check the Save Password check box, Windows 95 saves your log-on information so you won't have to enter it next time.

and see if the problem remains. If it does, try the next item in the list.

- *Save Password requires a successful connection.* The Save Password feature requires a successful connection before your password information will be saved. If you're having difficulty using the Connect To dialog to connect to a service provider, double-check your user name and password information and try

again. Remember to change your user name to the one required for the service to which you're attempting to connect. For example, the Connect To dialog will start off with your Windows user name, but if you're attempting to connect to CompuServe you should substitute your CompuServe ID instead.

- *Don't press Esc at log-on.* If you press Esc to bypass the log-on dialog when Windows first starts, password caching will be disabled, *Save Password* will be grayed out and unavailable, and you'll have to supply a password whenever one is requested. This is because Windows 95 doesn't open the password file and associate its contents with your user name and password if you haven't successfully logged on. When you press Esc, you skip logging on.

Note that this is different from skipping the log-on dialog by automatically logging on. For example, if you establish a null password by entering your user name and leaving your password blank the first time Windows 95 asks, Windows won't present the log-on dialog when you start up unless you're using User Profiles. Instead, Windows automatically logs you on and opens your password file.

If you are using User Profiles (so that each user can have customized desktop settings and so on), Windows *must* present the log-on dialog so it can determine whose custom settings to load and whose password file to open. In that case you must succeed at logging on for the Save Password function to work.

Note also that when you use the automatic log-on feature, anyone who can start your computer has potential access to all of the resources protected by passwords stored in the password cache. So you might want to make sure the log-on dialog is always presented. To change your password, select the Start menu, select *Settings*, select *Control Panel*, and then choose *Passwords*.

- *Make sure you have a network client installed or user profiles enabled.* For the Save Password feature to work you must have either a network client installed (Client for Microsoft Networks or Client for NetWare Networks) or User Profiles enabled. If you don't, the *Save Password* check box will be grayed out. To install a network client, select the Start menu, choose *Settings*, choose *Control Panel*, double-click on the Network icon, then choose the *Add* button. To enable User Profiles, select the Start menu, choose *Settings*, choose *Control Panel*, choose *Passwords*, select the *User Profiles* tab, and select

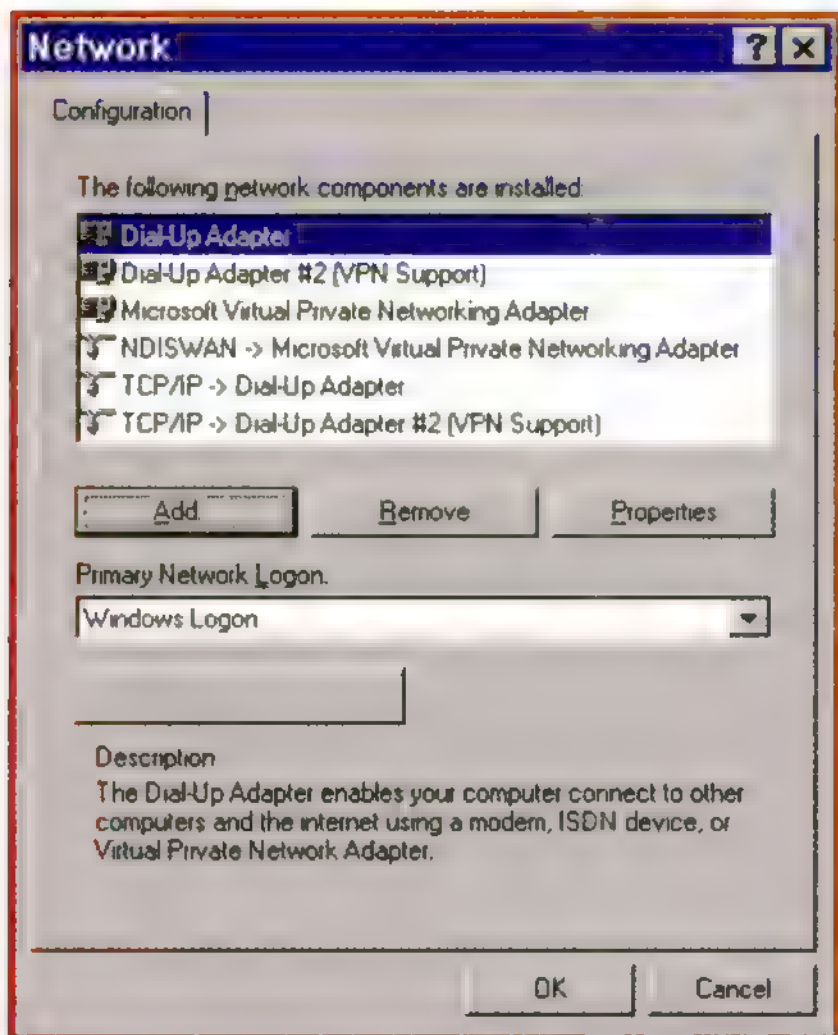


FIGURE 2: The Network applet in Control Panel, after installation of the Dial-Up Networking 1.2 upgrade.

"Users can customize their desktop preferences and settings."

- *Check to see if password caching is disabled.* It's possible your system administrator has disabled password caching. If this is the case, you may still be able to check *Save Password*, but the information won't be saved. In corporate environments where security is a concern, the system administrator can disable password caching to force you to enter a password every time one is requested. Password caching can be disabled by adding the following value to the Windows 95 Registry:

```
HKEY_LOCAL_MACHINE\Software\Microsoft\
Windows\CurrentVersion\Policies\
Network\DisablePwdCaching
```

If the `DisablePwdCaching` value is set to 1, which means True, then password caching is turned off. If it is set to 0 (False) or if it's not present at all, password caching is turned on. In a default installation of Windows 95, the `DisablePwdCaching` value doesn't exist and password caching is turned on. But your network or system administrator may have established system policies that override the default.

If the `DisablePwdCaching` value is present and set to True, you'll have to edit the Registry and change that value to False for the *Save Password* feature to work. You can edit the Registry using either System Policy Editor (`Poledit.exe`) or Registry Editor (`Regedit.exe`), programs located on the Windows 95 CD, but you should check with your adminis-

trator before you make any changes to the Registry. Registry editing should be reserved for the knowledgeable, because mistakes can render your system unusable or send it into an insidious decline. At the very least you should make backup copies of the two Registry files, `User.dat` and `System.dat`, before you try to edit the Registry.

- *Check for an auto-log-on value in the Registry.* If your vendor or system administrator performed an unattended batch installation of Windows 95 and forgot to remove this entry, the *Save Password* check box will be grayed out and unavailable. The auto-log-on value prevents the display of a Windows or network log-on dialog box, which in turn prevents you from logging on, thus disabling the password cache. It's supposed to be added to the Registry temporarily and then removed after the system reboots during an unattended installation.

To see if this value exists, look for an auto-log-on value under the following Registry key:

```
HKEY_LOCAL_MACHINE\Software\Microsoft\
Windows\CurrentVersion\Network\Real
Mode Net
```

If the auto-log-on value exists, you or your system administrator should delete it from the Registry, using either the Registry Editor or System Policy Editor (the same cautions apply as mentioned earlier). Then shut down Windows and reboot the computer.

- *Install updated Windows 95 components.* If you're running the original release of Microsoft Windows 95, otherwise known as OSR1 (OEM Service Release 1), you should install the Windows 95 Service Pack 1 update followed by the Enhanced Password Cache Security update. Although a number of additional updates to Windows 95 are available, these two in particular fix problems that could cause the *Save Password* feature to fail.

If you're not sure what version of Windows you have, highlight the My Computer icon on the desktop, then right-click and select *Properties*. If the version number doesn't end in a B, you have OSR1. If it does end in a B, you have OSR2. If you have OSR2, you don't have to install the Service Pack 1 and Enhanced Password Cache Security updates mentioned above—they're already installed.

If you're running OSR1 you should install Service Pack 1 first. Then shut down Windows, reboot your computer, and install the Enhanced Password Cache Security update.

This update fixes problems that can cause corruption in the password file. For example, when two users whose user names have the same first eight characters log on to the same Windows 95-based computer, the password file gets corrupted. The Enhanced Password Cache Security update prevents this problem.

The Windows 95 Service Pack 1 can be downloaded from the Web at www.microsoft.com/windows/software/servpak1/sphome.htm or via FTP at [ftp.microsoft.com/softlib/mslfiles/setup.exe](ftp://ftp.microsoft.com/softlib/mslfiles/setup.exe). To install the update, download the file, execute it, and then follow the instructions.

The Enhanced Password Cache Security update can be found at www.microsoft.com/kb/articles/q132/8/07.htm. The file can also be obtained via FTP at [ftp.microsoft.com/softlib/mslfiles/mspwlupd.exe](ftp://ftp.microsoft.com/softlib/mslfiles/mspwlupd.exe). To install the update, download the file `Mspwlupd.exe` and run it. Follow the instructions, then shut down Windows 95 and reboot the computer.

- *Let Windows create new password files.* If the `<Username>.pwl` password file becomes damaged, that causes the password caching mechanism to break down. There's no easy way to test for damage, but if you suspect it you can delete the password file, shut down Windows, and reboot the computer. The next time you boot up and enter your Windows user name and password, a new password file will be created. You'll have to reenter all of your passwords again the first time; they're needed by those applications that support the password cache mechanism.

Among the passwords saved in the password file are those for network shares and printers, dial-up networking connections, Windows log-on, Windows NT domains, and Novell server passwords, as well as those for other applications that use the Master Password API, such as the Microsoft Mail client and Microsoft Investor (when you use Investor's value-added services). Letting Windows recreate the password file often solves the *Save Password* problem.

Note that you should shut down Dial-Up Networking and any other program that might use the password-caching mechanism *before* you delete the password file, which is located in your Windows directory. Then delete the file, shut down Windows, and restart your computer.

It's also possible that your `Rna.pwl` file, if it exists, is damaged. This file holds passwords for the Dial-Up Networking server when you use the server with share-level access. To eliminate the possibility of a damaged `Rna.pwl` file, follow the same procedure with this file as that described above for a damaged `<Username>.pwl` file. Make sure all DUN components are



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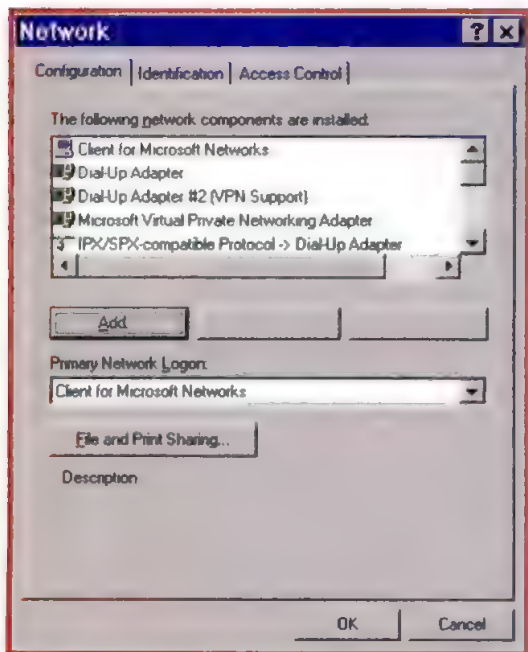


FIGURE 3: The Network applet in Control Panel, after installation of Client for Microsoft Networks and needed protocols.

not running, delete the file, shut down Windows 95, and reboot the computer.

- **Uninstall and then reinstall the Windows 95 Dial-Up Networking components.** If one or more of the files associated with Dial-Up Networking is missing or damaged, that could cause the password cache mechanism to stop working. This step, which consists of uninstalling Dial-Up Networking and then installing the most current Dial-Up Networking component available from Microsoft, will replace the missing or damaged files. The procedure discussed here is for users of all OSR1 and OSR2 releases of Windows 95.

To remove Dial-Up Networking, follow these steps: Select the Start menu, select *Settings*, select *Control Panel*, double-click on the Add/Remove Programs icon, select the *Windows Setup* tab, select *Communications*, and select *Details*. Click on the *Dial-Up Networking* check box to clear it, then click *OK*, then restart your computer when you are prompted to do so.

Removing Dial-Up Networking also removes any Windows components that depend on it, such as Direct Cable Connection or an ISDN device. You'll have to reinstall these components later. You may also find that the Dial-Up Adapter and associated network protocols have been removed. We'll check on these after reinstalling Dial-Up Networking. Also, to start with a really clean slate, delete the <Username>.pwl and Rna.pwl password files from your Windows directory.

Now, to install the most current Dial-Up Networking components, you'll need Microsoft's Dial-Up Networking 1.2 upgrade, which includes all of the DUN improvements made to Windows 95 OSR2 and the ISDN 1.1 Accelerator Pack, as well as support for the point-to-point tunneling protocol (PPTP). It also includes the scripting facility for automating log-on interaction with online services and Internet service providers. The filename for the Dial-Up Networking upgrade is Msdun12.exe, and you can download it by going to <http://microsoft.com/ntserver/info/exes/msdun12.exe> with your Web browser (note the absence of the usual www at the beginning of the link). You can also find it in the Windows 95 Setup Forum on CompuServe (GO SETUP95) or at www.download.com (search for Dial-Up Networking Upgrade 1.2).

Downloading and running the Msdun12.exe file installs the updated DUN components. During installation you may be asked to supply your original Win-

dows 95 installation CD-ROM when the setup program looks for needed files. After you supply the needed CD, if the installation program says an existing file is newer than one you're trying to install, always choose to keep the newer file.

If the installation program doesn't find an existing TCP/IP protocol stack, you'll be notified and asked whether to install the updated TCP/IP stack. If you want to access the Internet or otherwise want TCP/IP installed, choose *OK*.

Next, make sure the required adapters and connection and network protocols are installed. Select the Start menu, select *Settings*, select *Control Panel*, and then double-click on the Network icon. You'll see the Dial-Up Adapter in the *Configuration* tab, among other things. The Dial-Up Networking 1.2 upgrade automatically installs the Dial-Up Adapter if it isn't already installed. You'll also notice additional adapters in the *Configuration* tab, even though you may have previously had only one. This is normal: The added adapters are required for the new PPTP support. Your Network applet display should look something like what you see in Figure 2.

If the Client for Microsoft Networks com-

ponent isn't shown in the *Configuration* tab, you must install it. To do so, choose the *Add* button, then select *Client*, choose the *Add* button, select *Microsoft*, select *Client for Microsoft Networks*, and then choose *OK*.

You may need your network administrator's help to determine which additional protocols to install. For instance, you'll need either Netbeui or IPX/SPX if you want to use Direct Cable Connection. To add the Netbeui protocol, choose the *Add* button, select *Protocol*, then choose the *Add* button. Select *Microsoft* and *Netbeui*, then choose *OK*.

The needed protocols must be "bound" to the Dial-Up Adapter in order for Dial-Up Networking to work. These bindings occur automatically as part of installation, but to be sure, select the Dial-Up Adapter in the *Configuration* tab of the Network dialog, select *Properties*, select the *Bindings* tab, and make sure the required protocols are checked. For example, to access the Internet using a dial-up connection, make sure the *TCP/IP to Dial-Up Adapter* communication protocol is checked. Choose *OK* to close the dialog.

Finally, if you want access to your files and printers to be shared with other computers on a network, you'll have to choose the *File and*

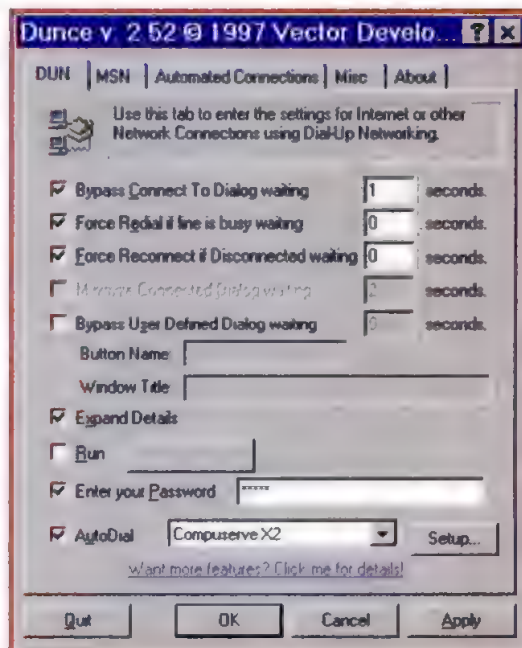
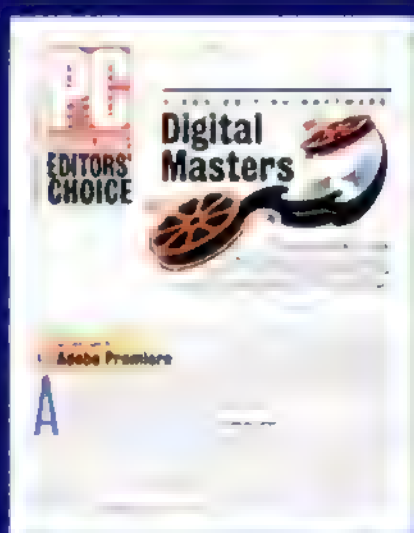


FIGURE 4: A popular third-party add-on to Dial-Up Networking, Duncer can automatically type in your password and send the Connect To dialog on its way.

Print Sharing button, check the appropriate boxes, and then choose *OK*. If you're accessing the Internet and don't want to make your files accessible to other users, you should select each TCP/IP protocol binding shown in the *Configuration* tab and, with each, choose

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Properties, select the *Bindings* tab, uncheck *File and Print Sharing*, and then choose *OK*.

When you're finished, your Network dialog should look something like what you see in Figure 3, depending on how many protocols you choose. Choose *OK* to close the Network applet. If you're asked to restart the computer, go ahead.

At this point, all that's left is to reinstall those components dependent on Dial-Up Networking that were removed when you uninstalled it. For example, to reinstall Direct Cable Connection, select the Start menu, select *Settings*, select *Control Panel*, double-click on the Add/Remove Programs icon, select the *Windows Setup* tab, select *Communications*, then select *Details*. Click on the *Direct Cable Connection* check box to check it, then click *OK*, then restart your computer when you are prompted to do so.

- *Try using a third-party Dial-Up Networking enhancement.* A large number are available for downloading from various Web sites, such as www.windows95.com. One popular add-on is Vector Development's Duncie (see Figure 4), whose name stands for Dial-Up Networking Connection Enhancement. You can set up Duncie so it will automatically type your password into Dial-Up Networking's Connect To dialog and then press *OK* for you. If you can't solve the Save Password problem otherwise, or if you need to run your system with password caching disabled, Duncie can help you automate the Connect To dialog. It provides a number of other useful features as well. The program can be downloaded from Vector Development's Web site at www.vecdev.com.

- *Write a replacement script that hard-codes the password.* If you're using the Scripting feature provided by Dial-Up Networking, you can edit your log-on script and substitute your user name and password for the \$USERID and \$PASSWORD system variables. Script files have an .scp file extension and are usually located in your Program Files\Accessories folder. For example, if your password is *glory* you would change `transmit $PASSWORD, raw` to `transmit "GLORY^M"` in the script. Of course this means your password is clearly defined in your script file, so anyone who can read your script file can read your password. Therefore this technique should only be used on a computer that is completely secure and only when all other attempts to solve the Save Password problem have failed. The documentation for the scripting facility can be found in the Script.doc file in your Windows folder. **PC**

Sal Ricciardi is a contributing editor of PC Magazine.

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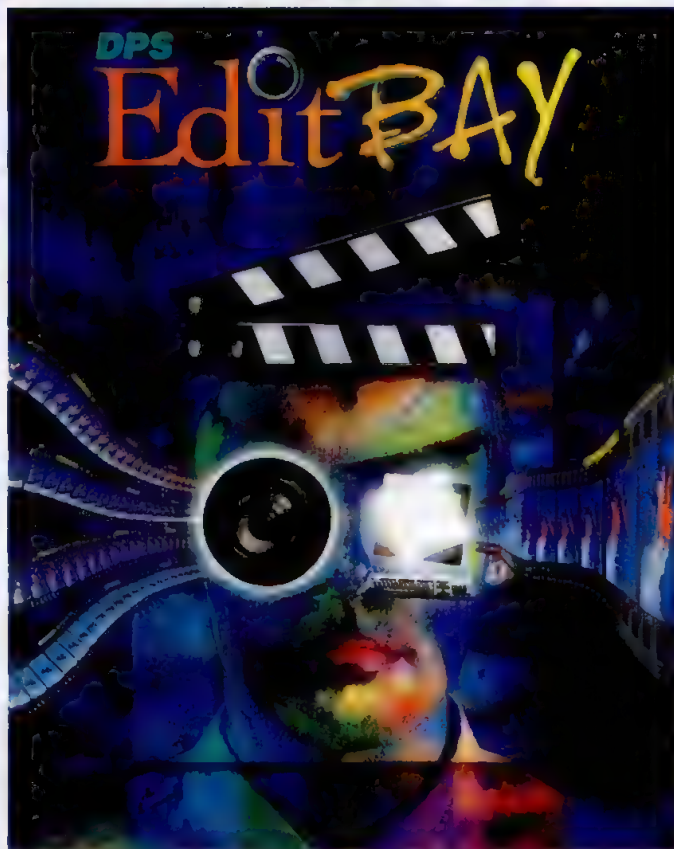
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Optimizing Windows CE Programs

Special considerations in programming for limited RAM and limited display space.

By Douglas Boling

Windows CE was designed from the ground up to be a new version of Windows for small platforms. And although it sacrifices backward compatibility by supporting only a subset of the Win32 API, Windows CE breaks new ground by extending a small version of Windows beyond systems based on the Intel x86 series of processors. In this column, we'll discuss some techniques for optimizing a Windows CE program to reduce its memory footprint. We'll also discuss the *command bar*, a new control unique to Windows CE that combines elements of a toolbar and a menu.

The most dominant aspect of Windows CE programming is the need to manage the limited amount of memory available to a program. Other Windows programs can assume an almost unlimited amount of memory. Even if a PC has only 4MB or 8MB of RAM, Windows can create copious amounts of virtual memory with a swap file on the hard disk. But Windows CE devices have as little as 2MB of RAM, with half of that dedicated to file storage. Windows CE applications must pare memory usage to the bone just to survive in such a low-memory environment. In planning your programs, you should know the different types of memory that can be allocated by Windows CE and how to get the most out of each.

The core set of memory allocation functions deals with virtual memory. Although Windows CE does not maintain a page file on a disk, it does have a memory protection scheme that supports page-based virtual memory. The virtual memory functions are the most basic level of memory allocation available to a program. They

should be used when a program needs a large block of RAM. Windows CE limits the size of any single virtual memory allocation under low-memory conditions. Allocations greater than 64K—or even 16K in some situations—will fail even if the system has more than the requested amount of memory available. That prevents any one program from hogging all available RAM.

When you make a request for virtual memory, you specify the size of the block in bytes. The system then rounds the allocation up to the next page boundary. Windows CE supports several processors—currently the Hitachi SH3, the NEC R4100, and the Phillips 3910—with differing page sizes, 1K on the

Hitachi and the NEC and 4K on the Phillips. With memory as scarce as it is, the difference can be bothersome. For example, in a system based on the Phillips CPU, a request for 10 bytes of RAM using `VirtualAlloc` returns a 4K block, and the same allocation request on a Hitachi system returns 1K. The challenge for programmers is in tuning applications to run well on all systems.

The heap is the best place to allocate small units of memory, say a hundred to a few thousand bytes. Unlike Windows 3.x with its 64K limits, Windows CE does not limit the heap to any fixed size. The operating system enlarges the heap as allocations are made. As the contents of the heap are freed, the system shrinks the total size of the heap, if possible. But Windows CE does not support relocatable memory blocks within heaps. That means the heap can become fragmented over time—and if Murphy has any say in the matter, a few small blocks will be distributed over a number of pages, so that memory cannot be freed by the system.

One way around the problem of fragmentation is to allocate a separate heap object using `HeapCreate`. Then you can allocate and free small blocks of memory within it. Although such a heap object suffers the same fragmentation as the heap itself, a heap object can be completely freed when its memory is no longer needed. Since heap objects require some overhead, you should avoid creating heaps that will be managing less than 5K of memory.

Unlike PCs, which typically are turned off every day or perhaps once a week, handheld PCs are never really off; they're just suspended in place. That means a program may run for months at a time. Programmers must take special care to understand the issues of keeping a program running for long periods of time. Since the system is very rarely rebooted, memory leaks will accumulate over time and can seriously affect performance.

Of course, the simplest place to allocate memory is on the stack, which does not get fragmented. The system automatically grows the stack, using `Vir-`

ExampleProg

Timestamp is 34156822 (Tue Sep 09 08:15:46 1997)

Preferred load address is 00010000

Start	Length	Name	Class
0001:00000000	00000cd8H	.text	CODE
0002:00000000	00000078H	.rdata	DATA
0002:00000078	00000000H	.edata	DATA
0003:00000000	00000004H	.CRT\$XCA	DATA
0003:00000004	00000004H	.CRT\$XCZ	DATA
0003:00000008	00000004H	.CRT\$XIA	DATA
0003:0000000c	00000004H	.CRT\$XIZ	DATA
0003:00000010	00000004H	.CRT\$XPA	DATA
0003:00000014	00000004H	.CRT\$XPZ	DATA
0003:00000018	00000004H	.CRT\$XTA	DATA
0003:0000001c	00000004H	.CRT\$XTZ	DATA
0003:00000020	00000180H	.data	DATA
0003:000001a0	0000020cH	.bss	DATA
0004:00000000	000001b8H	.pdata	DATA
0005:00000000	0000028H	.idata\$2	DATA
0005:00000028	00000014H	.idata\$3	DATA
0005:0000003c	00000098H	.idata\$4	DATA
0005:000000d4	00000098H	.idata\$5	DATA
0005:0000016c	00000280H	.idata\$6	DATA
0006:00000000	00000220H	.rsrc\$01	DATA
0006:00000220	000008ecH	.rsrc\$02	DATA

FIGURE 1: This is a fragment of a map file generated during the compilation of a Windows CE program. If you know how to read it, you can determine the sizes of the static data segments allocated by the compiler.

tual allocation, as data is pushed onto it. There is a limit—just over 50K—of stack memory that can be allocated for any function. But that should not be a problem, except in the most extreme cases.

Just as virtual memory allocations can fail for programs in low-memory situations, they can also fail when the system attempts to grow the stack. When the system cannot grow a stack, it suspends the thread that owns the stack until memory can be freed. Understanding this is critical when you're designing a program to run under low-memory situations.

When memory gets too low, the system asks the user to close a program. A `WM_CLOSE` message is then sent to the window of the program the user has selected to be terminated. If the program pushes a large amount of data onto the stack and the system cannot grow the stack, the program will be suspended. If the program does not close within 8 seconds, the system forcibly stops its threads and removes it from memory, which could cause a loss of data.

To avoid such a situation, a program should not push large amounts of data onto the stack as it terminates. If you have a Save Changes? dialog created but hidden, ready to be shown when the program needs to close, then you'll avoid having to allocate the memory for the dialog at termination.

STATIC MEMORY

Another kind of memory use can be managed to reduce the memory footprint of a program. *Static memory* is data declared statically in the program at compile time.

As is the case with other memory in the system, the fundamental unit of allocation for static data is the page size of the processor. This means if a program has 1 byte of statically allocated data, the system allocates one page (1K or 4K, depending on the CPU) for that data. The compiler typically allocates some static data for its own use, so eliminating static data totally is difficult, but knowing how much has been allocated helps you manage it. In some cases, reusing leftover static data space in a page is better than dynamically allocating memory.

A Windows CE program allocates two static data segments at compile time, one for variable static data and one for constant static data. Each segment has its own set of pages, which are allocated when the program is loaded into memory. Moving constant data to leftover space in the static data pool can be beneficial if doing so reduces the number of pages necessary to hold the constant data. You would not, however, want to move con-

stant data in a program that executes from ROM, because such a program keeps its constant data, and the size of the segment has no impact on how much RAM the program uses. Also, when writing a program to be executed from ROM, you should specify as much data as possible as constant. Any leftover space in the static data segment can be better used for other writable data.

To see the size of the static data segments allocated by the compiler, look at the map file. In Visual C++ 5.0, map file generation is enabled on the link page of the Project Settings dialog. The fragment of a map file in Figure 1 shows the three lines you should examine. The `.rdata` line shows the size (in hexa-

The functions you
use to manage a
command bar are a subset
of the familiar functions
that deal with menus
and toolbars.

decimal) of the read-only data segment. The `.data` line shows the initialized data, and the `.bss` line shows the size of the uninitialized data segment. When the program is loaded, the loader will combine the `.data` and `.bss` segments into one segment, so the critical number for read/write data is the sum of the `.data` and `.bss` segments.

The `.rdata` and read/write data segments should not exceed the page-size value for your target processor. Since you'll probably want most of your programs to run on any processor, the key values are 1,024 (400 hex) and 4,096 (1000 hex). Removing the keyword `const` from a static variable declaration moves that variable from the read-only (`.rdata`) segment to the read/write (`.data`) segment. For the program that generated the map file shown in Figure 1, the read-only segment is 120 (78 hex) bytes in size, and the read/write segment is 908 (38C hex) bytes. Rounded up to the next page boundary, both segments take 1,024 bytes on a system with an NEC R4100 CPU.

Although saving 1K of RAM may not seem like a big accomplishment, the scarcity of memory on an HPC or other Windows CE device cannot be overemphasized. Devices may have only 1MB of RAM available for sys-

tem RAM, and the operating system can use 600K or more of that. Add a program or two and a bit of data and you can easily run out of system RAM. The suspend/resume feature of Windows CE contributes to this squeeze, since you don't have to shut down programs when you turn off (or suspend) the device. You may be running programs you haven't accessed in days. Like free hard disk space on a PC, an HPC's available RAM is of little concern to a user until there is not enough to accomplish some task. Then—and only then—will a user close some programs to make room.

THE COMMAND BAR

Programming the command bar is another novelty that differs from standard Windows programming. The command bar is a menu bar combined with a toolbar in order to conserve a line on the small display. The functions you use to manage a command bar are a subset of the familiar functions that deal with menus and toolbars.

To create a command bar, use the `CommandBar_Create` function. Unlike the window menus supported by other versions of Windows, the command bar must be explicitly created by your program, typically during processing of the `WM_CREATE` message.

Once you've created the command bar, typically the first thing you'll do is add a menu to it. This is done with the `CommandBar_InsertMenubar` function, to which you pass a menu handle that you create dynamically or by loading a menu from a resource. Windows CE supports a fairly complete set of menu-management functions, albeit with some limitations, the most glaring being the lack of support for cascading menus. Windows CE also does not support multicolumn menus, menu buttons, and menu bitmaps (check marks are supported). Although Windows CE allows the menu to be positioned anywhere on the command bar, in practice it should be the leftmost item, according to Microsoft's user interface guidelines.

After adding menus, you add the buttons and perhaps a combo box to the command bar. Adding buttons is a two-step process. First you load the bitmaps containing the button images into the control using the `CommandBar_AddBitmap` function. Each bitmap should contain a strip of one or more buttons, each 16 by 16 pixels. The system provides two bitmaps. The first contains standard button images for open, save, properties, cut, copy, paste, and a handful of other functions. The other contains images used by Explorer, such as those for large-icon view,

details view, and sorting.

Once you've loaded a bitmap into the command bar, you can add buttons by passing an array of buttons to the `CommandBar_AddButtons` function. Each button's image is identified by a zero-based index into the previously loaded bitmaps. If you loaded more than one bitmap into the command bar, the second set of images is indexed from the end of the first bitmap. For example, if the first bitmap contained five images, the first image in the second bitmap would be referenced as image 5.

Adding a combo box to a command bar is as simple as calling `CommandBar_InsertComboBox` and specifying the style of the combo box (only `CBS_DROPDOWNLIST` and `WS_VSCROLL` are allowed) and the position of the combo box relative to the other buttons on the command bar.

You can add ToolTips to a command bar with `CommandBar_AddToolTips`, passing an array of strings containing the ToolTip text for each command bar control. Since the command bar saves a pointer to the array of strings, not the string data itself, the array must be allocated in a memory block that's retained for the life of the command bar—not on the stack.

When you've added all your controls to the command bar, you should call `CommandBar_AddAdornments`. This function adds a close box to the extreme right of the command bar and can also add *Help* and *OK* buttons. Call `CommandBar_AddAdornments` only after you've added all your buttons and other controls to the command bar.

The command bar sits in your window's client space, so when your program handles a `WM_PAINT` message, it must take into account that the command bar is hiding some of the window. To determine the size of the visible portion of the client window, use the `CommandBar_Height` function to get the height of the command bar and add it to the value `rect.top` returned by `GetClientRect`.

The command bar is only one of the unique features available to Windows CE programmers. The whole system is designed to make it easier for applications to be written for handheld computers. Although Windows CE has a number of limitations stemming from its reduced API, the next version will increase the number of functions available. In addition to supporting more of the Win32 API, the next version will add new controls that will make writing Windows CE applications even easier. 

Douglas Boling is a contributing editor of PC Magazine.

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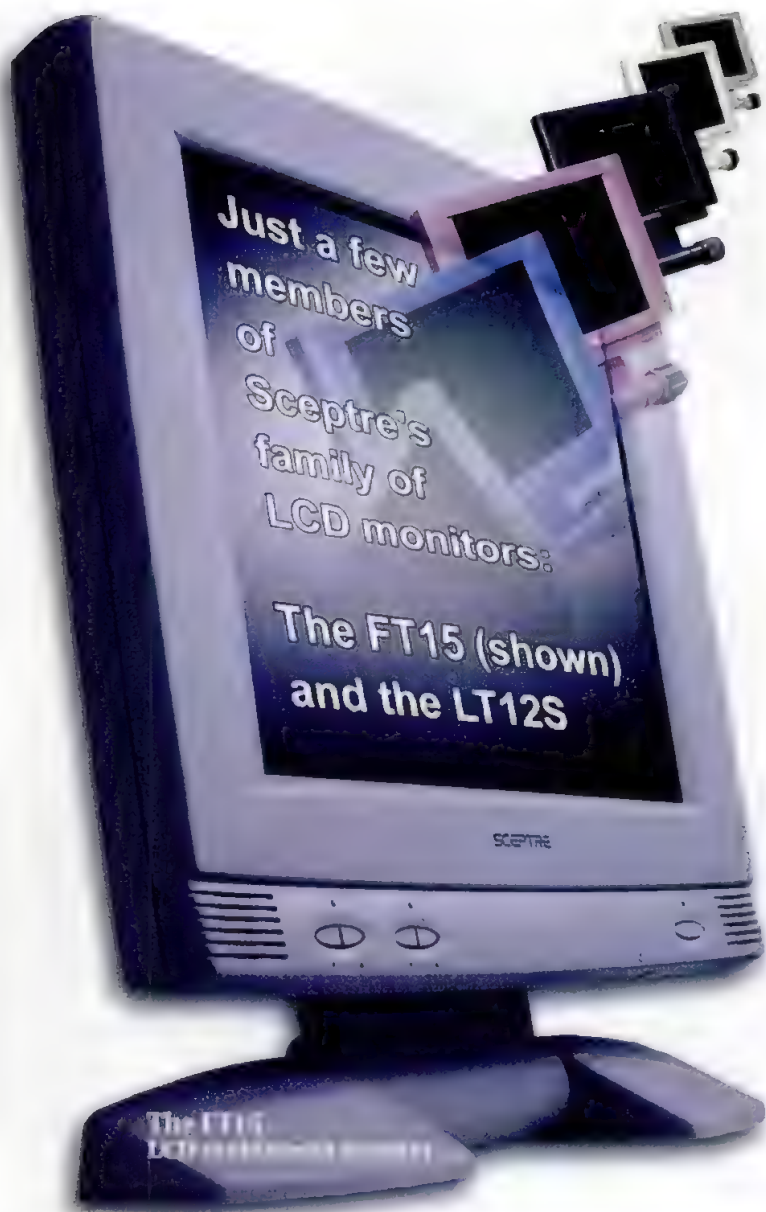
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WinTidy 95 Rearranges Your Desktop Icons

WinTidy 95 straightens up the icons on your desktop even when you use different screen resolutions.

By Neil J. Rubenking

Keeping a tidy Windows 95 desktop isn't easy. If you change your display settings to a lower resolution, any icons that would be outside the new boundaries get pushed back into view and end up piled on top of each other. Unfortunately, changing back to a higher resolution doesn't restore the original icon positions. And if your hand shakes while double-clicking on an icon, you can wind up moving the icon instead of launching the application or document.

WinTidy 95 straightens up your desktop and keeps it in order. Use its predefined icon layouts to create an initial arrangement, then fine-tune the icons' positions. When you're ready, you can associate the layout with your current screen resolution or save it under the name of your choice. You can set WinTidy 95 to tidy your desktop automatically when the utility starts up and whenever the screen resolution changes. And you can launch the program with a layout name on the command line to restore a layout.

You can obtain WinTidy 95 by downloading it from PC Magazine Online or by mail. Refer to the sidebar "Getting the Files" for details. The source code for WinTidy 95—which was written with Borland's Pascal-based visual programming tool, Delphi—is provided for those interested in seeing how it works.

INSTALLATION

Run the WinTidy 95 installer to put the utility and all its files into the directory of your choice. The installer also adds shortcuts to WinTidy 95, its help file, and an uninstaller to your Start menu. In addition, Install puts a shortcut to the utility into your StartUp folder. You can remove the shortcut if you prefer not to run WinTidy 95 each time Windows 95 starts. To do so,

right-click on the taskbar, select *Properties*, click the *Start Menu* tab, and click on the *Remove* button. Then navigate to the StartUp folder and remove the WinTidy 95 item.

WinTidy 95 works only under Windows 95. It takes advantage of a Windows 95 feature for getting and setting the positions of icons on the desktop. Windows NT's enhanced protections against interprocess memory corruption prevent WinTidy 95 from working with that operating system.

WinTidy 95

WinTidy 95 offers predefined icon layouts that can be saved and associated with your current screen resolution. You can launch a layout by name from a command line to restore it. WinTidy 95 runs only under Windows 95; it does not run under Windows NT.



USING WINTIDY 95

Start by putting the icons on your desktop into the arrangement you prefer. That will be easier if you first close all open windows or right-click on the taskbar and choose *Minimize All*. Make sure that *Arrange Icons | Auto Arrange* in the desktop's right-click context menu is unchecked. Launch WinTidy 95 and watch for its broom icon in the system tray. To open the main window, double-click on the tray icon or right-click on the icon and choose *Open* from the menu. Click the button with

the zigzag design to bring up the *Arrange* window, which presents 12 predefined icon layouts. The zigzag pattern on the button represents the currently selected layout. Figure 1 shows the main window on the left and the *Arrange* window on the right.

The predefined layouts give you a starting point for arranging your icons. Figure 2 shows one of these in action. You can drag and drop the icon titles in the list to put them in any order. The list auto-scrolls if you drag an item and hold the mouse just inside the top or bottom. If you prefer, you can use the *Up* and *Down* buttons to reposition a highlighted item in the list. When you click the *GO!* button, WinTidy 95 will instruct the desktop to reposition all the icons. If the resulting arrangement doesn't suit you, try another layout or adjust the icon positions manually.

The next step is to save your layout. Click the *Save* button in the top-left corner of WinTidy 95's window. Clicking the button associates the icon layout with your current screen resolution, which is shown above the button. If you use other resolutions, switch to each in turn and repeat the process, saving a layout for each resolution.

WinTidy 95 saves the icon positions in the file *Tidy95.ini*, using the title of the icon as the .ini file key. Under certain rare circumstances, you might have a desktop icon with no title or two desktop icons with the same title. If either situation occurs, WinTidy 95 displays a warning message and skips the problematic icon or icons.

The *Restore* button near the top-left corner is enabled any time a saved layout for the current screen resolution is available; click it to restore the layout. If you check the *Smart restore* box, WinTidy 95 watches for changes in screen resolution and automatically loads the layout corresponding to the new resolution. Checking the *Restore on launch* box causes WinTidy 95 to restore the layout for the current resolution each time you launch the program. Checking both boxes makes WinTidy 95's operation almost completely automatic—you don't even have to look at its main window again, unless you add or remove icons from the desktop. Note, too, that all of WinTidy 95's functions except predefined

FOR PROGRAMMERS ONLY WinTidy 95 was written with Borland's Pascal-based visual programming tool, Delphi. The full source code for WinTidy 95 is available on PC Magazine's Web site (www.pcmag.com/download) and demonstrates the following programming techniques:

- creating memory that can be shared with Explorer, using memory-mapped files;
- creating an auto-scrolling list box;
- detecting and responding to changes in display settings.

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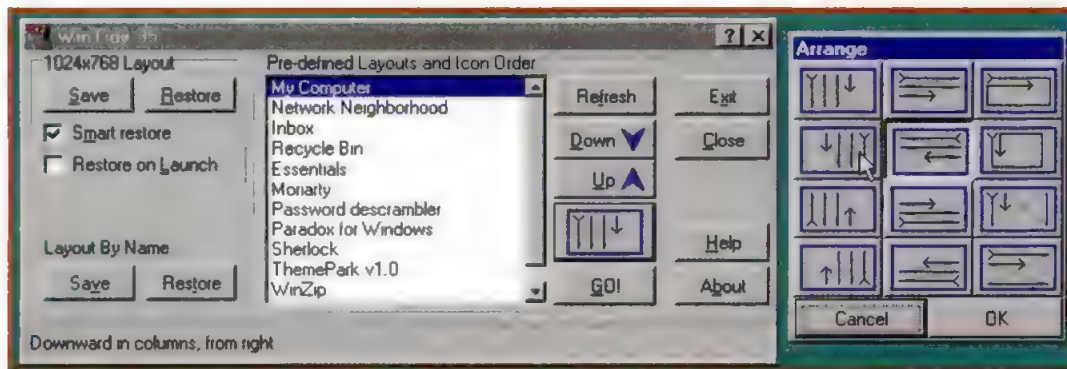


FIGURE 1: WinTidy 95 lets you arrange your desktop icons, then save and restore your layout.

icon layouts can be accessed from the context menu that appears when you right-click on the system tray icon.

If you add, remove, or rename icons on the desktop, your saved layout will no longer match your display. You can still restore a saved layout, but WinTidy 95 informs you when items on the desktop aren't in the saved layout or when items in the layout aren't on the desktop. Just put any new icons in their places and save the layout again.

You may find that you want different desktop layouts for different situations. For example, one layout may be appropriate for designing a presentation, but you might want another for creating a spreadsheet. WinTidy 95 lets you save and restore layouts under user-defined names using the *Save* and *Restore* buttons in the *Layout by Name* control group. The layouts are stored in Tidy95.ini along with WinTidy 95's other settings, so any name that's a valid .ini file section name is permitted *except* Settings. WinTidy 95 cannot add or remove icons from your desktop; it can only rearrange what is there.

If you put the name of an existing layout on WinTidy 95's command line, the program loads the layout at start-up, overriding the *Restore on Launch* option. If WinTidy 95 is already running, relaunching it with the name of a layout on its command line causes the specified layout to be loaded (but will not load another instance of the program).

That's all there is to it. Once you've created and saved an icon layout for each screen resolution you use, you can sit back and let WinTidy 95 keep your desktop in order.

INSIDE WINTIDY 95

The toughest task in programming WinTidy 95 was arranging for it to communicate with the desktop to get and set the icon positions. I was able to create the necessary shared memory using memory-mapped files, but that works only under Windows 95 and not under Windows NT. A more generally useful tech-

nique demonstrated by WinTidy 95 is the auto-scrolling list box. And once you know how to make a program respond to changes in display settings, as WinTidy 95 does, you can write programs that adapt to those changes in other ways.

CHATTING WITH THE DESKTOP

A little poking around with a spy utility reveals that the Windows 95 desktop icons are contained by a ListView control. The control is similar to the ListView that displays files in the right-hand pane of an Explorer window, but the desktop's ListView is always in the display mode corresponding to Large Icons.

To get information about the icons on the desktop, or to change their positions, WinTidy 95 must obtain the window handle of the desktop ListView. The parent of the desktop ListView is a win-

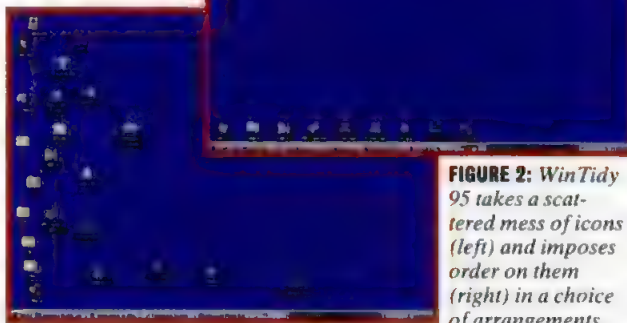


FIGURE 2: WinTidy 95 takes a scattered mess of icons (left) and imposes order on them (right) in a choice of arrangements.

dow whose class name is SHELLDLL_DefView, and the parent of that window is the main desktop window, whose handle can be obtained by the function call

```
FindWindow("Progman", "Program Manager");
```

Observation suggests that the desktop ListView is always the first child window of the SHELLDLL_DefView window, which in turn is

always the first child of the main desktop window. But there's no guarantee this is always true, so WinTidy 95 uses the API function EnumChildWindows to locate the ListView.

WinTidy 95 performs three actions that involve stepping through the list of icons contained by the desktop ListView: It gets a list of titles, saves their positions, and restores saved positions. All three actions are handled

by the IterateIcons function. IterateIcons has to get around a serious problem involving ownership of memory. The Win32 API provides a large group of messages for getting and setting information about items contained in a ListView, including their titles and positions. Most of these messages carry with them the address of a buffer into which the returned information is placed. Problems arise when the sender of the message and the ListView are different processes. If the calling program allocates the buffer, the ListView doesn't have access to the memory. If the buffer is allocated in memory accessible to the ListView, the calling program can't touch it. The two programs have different memory contexts, and a pointer that's valid in one will be useless in the other.

A quirk of the way Windows 95 handles memory-mapped files provides a solution. Memory-mapped files are allocated in the upper 2GB of the virtual memory space, and memory in that range is accessible to all processes. Windows NT, with its enhanced protection of programs against corruption by other processes, closes this loophole. Under Windows NT, memory-mapped files are accessible only through the API functions that permit creation and opening of

memory-mapped files. That's why WinTidy 95 doesn't work under Windows NT.

IterateIcons defines a data type called TSharedStuff, which is a record containing a PChar buffer, a TLVITEM structure, and a TPOINT structure. The function establishes a memory-mapped file containing one instance of TSharedStuff. Because this structure is allocated in the upper 2GB of virtual memory space, it is accessible to all processes.

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IterateIcons gets the number of desktop icons by sending an LVM_GETITEMCOUNT message to the desktop ListView. Then for each item it sends LVM_GETITEM to get the title and LVM_GETPOSITION to get the position. The data returned by the ListView in response to the LVM_GETITEM message goes into the TLVITEM and Buffer fields of the shared memory structure; the data returned in response to the LVM_GETPOSITION message goes in the TPOINT field.

The procedure OneIcon takes care of the exceptions. If an icon has no title, or if its title is the same as an already recorded icon's, WinTidy 95 pops up a warning and ignores the item. For all other icons, the program adds the title to the string list variable named DeskIcons. What happens next depends on what action was requested. When saving to the .ini file, the program records the title as a key name in the specified section with the position (converted to a single integer) as the value. When restoring from the .ini file, WinTidy 95 gets the desired position for the title and sends LVM_SETITEMPOSITION32 to place the icon. When getting a list of titles, the program does nothing further.

AUTO-SCROLLING

It takes just a few lines of Delphi code to enable drag-and-drop reordering of items in a list box. But if the list is long, the destination may not be visible, which forces you to make the move in several stages. WinTidy 95 implements a simple auto-scrolling list box to avoid that problem. If the mouse pauses over the first or last visible item, the list box automatically scrolls to reveal more items in the appropriate direction.

The list box's OnStartDrag event handler records the current ItemIndex in the variable OldPos. The OnDragOver handler records the item under the mouse cursor in the variable NuPos and signals acceptance only if the

cursor is actually over an existing item. The OnDragDrop handler moves the item in OldPos to NuPos and sets the ItemIndex to NuPos. Those three simple event handlers would be sufficient to implement drag-and-drop reordering without auto-scroll. The OnDragOver handler also checks to see whether the mouse cursor is over the first or last visible item in the list box. If so, it enables a timer

WinTidy 95 implements a simple auto-scrolling list box that makes drag-and-drop reordering of items simple.

component and sets the variable GoingUp to True if the mouse is over the first visible item, False otherwise.

Each time the timer component ticks over, it scrolls the list box up or down one item, depending on the value of GoingUp. If it reaches the top or bottom of the list, it disables itself. The list box's OnEndDrag event handler also disables the timer. The result? When you're dragging and you hold the cursor over the top visible item, the list scrolls down to reveal more items at the top. If you hold the cursor over the bottom visible item, the list scrolls up to reveal more items at the bottom. Very convenient!

RESOLUTION CHANGES

The Win32 API permits any program to change the current screen resolution by calling ChangeDisplaySettings. This function can change the screen resolution, color depth,

and other display settings, or it can report whether a desired change would be permitted. Utilities like QuickRes (part of Microsoft's free Power Toys collection) put the power of ChangeDisplaySettings into the hands of the end user. Some modern programs, mostly games, automatically switch to their desired display settings when they start and restore the prior settings after they finish.

Whenever the display resolution changes, Windows broadcasts a WM_DISPLAYCHANGE message to all running applications. A WM_DISPLAYCHANGE message brings the new color depth (expressed as bits per pixel) in its wParam and the new screen width and height in the low and high words of its lParam. WinTidy 95 responds by calling its internal function ReportResolution, which modifies the caption of the current-resolution group of controls to reflect the new screen dimensions and enables or disables the Restore button, depending on whether a stored layout is available. If the Smart Restore check box is checked and a stored layout is available, this function automatically restores it.

It's important to keep in mind that the screen width, screen height, and color depth are subject to change while a program is running. If your program needs to know these settings, don't just check them at start-up and assume they'll stay the same. Instead, have the program respond to WM_DISPLAYCHANGE.

The Windows 95 Arrange Icons feature permits you to line up your desktop icons along the left edge of the screen by name, type, size, or date. WinTidy 95 offers 12 standard layouts, and you can put the icons in whatever order you wish, save your layout to disk, and restore it on command. If you want to keep your desktop neat, try using WinTidy 95. **PC**

Neil J. Rubenking is contributing technical editor of PC Magazine.

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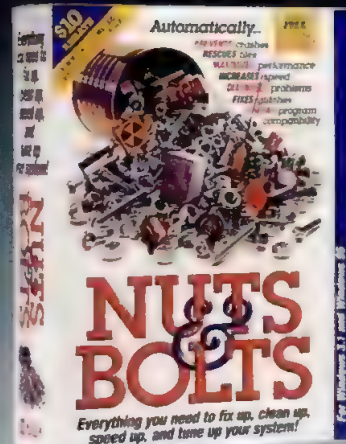


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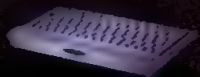
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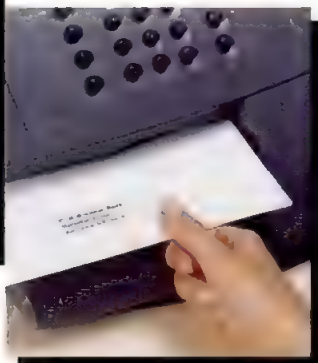
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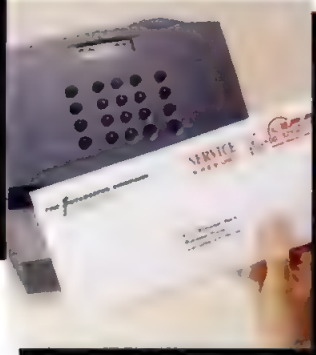
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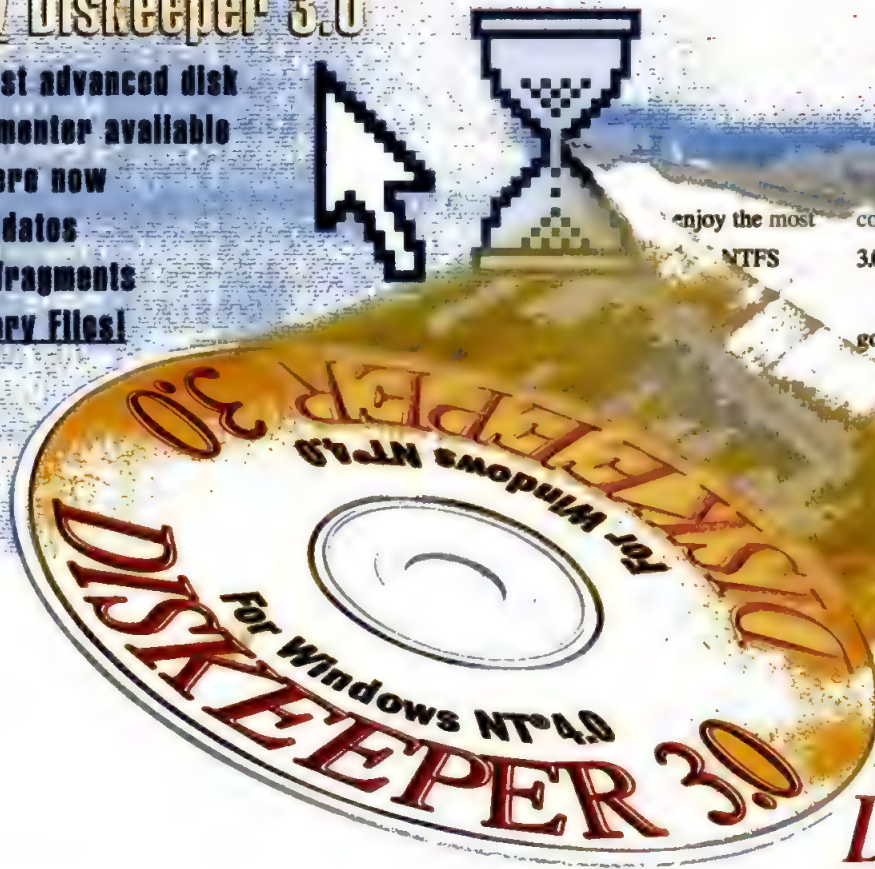


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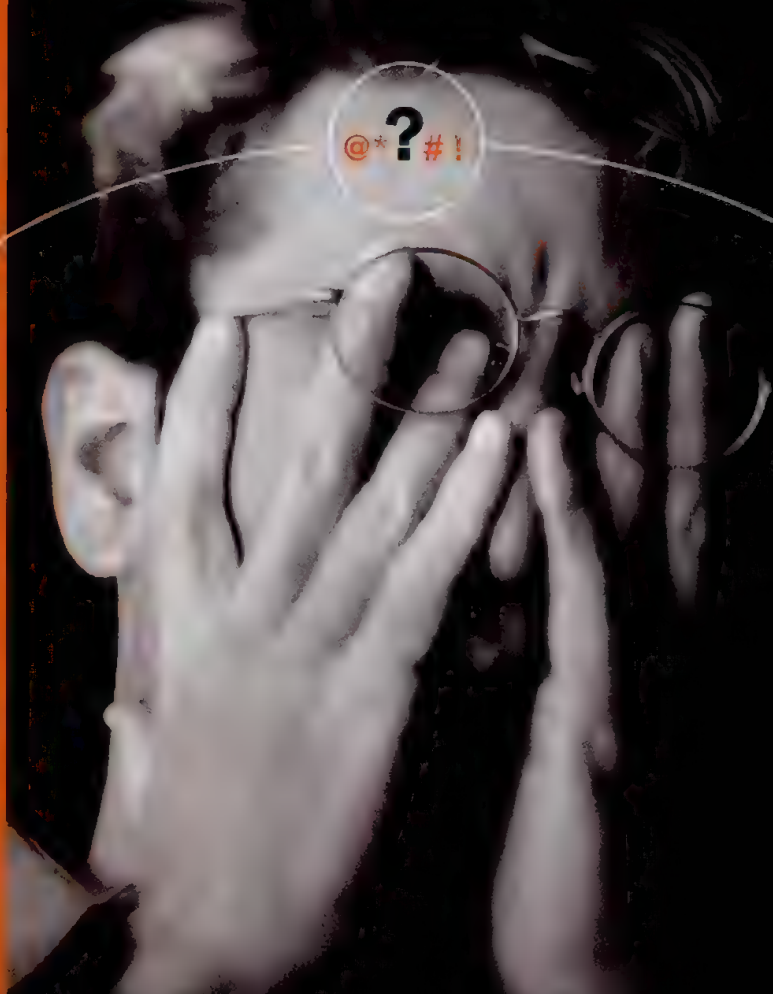
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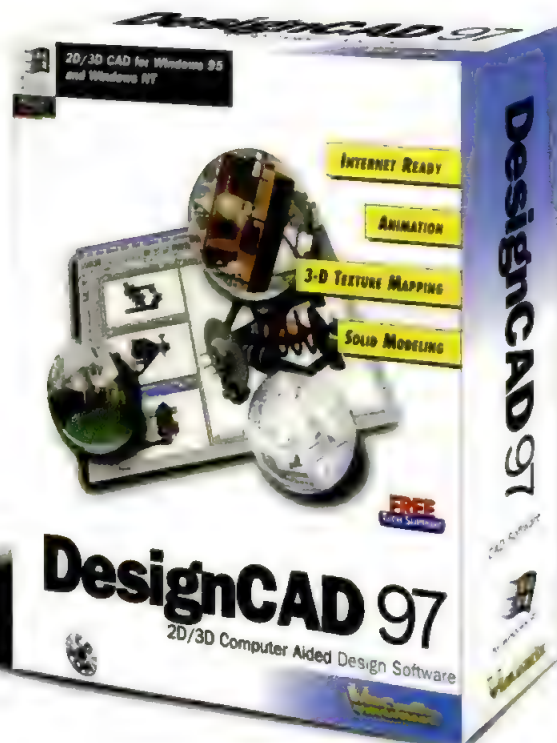
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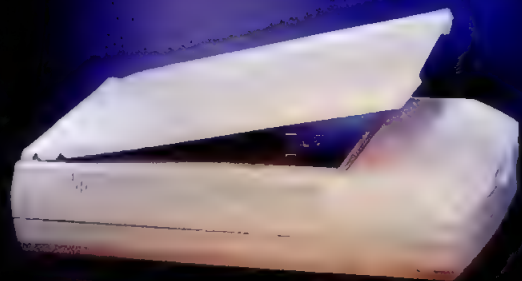
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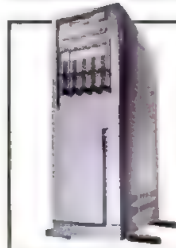
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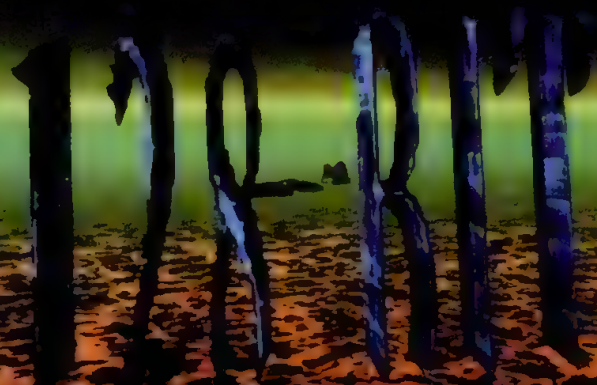
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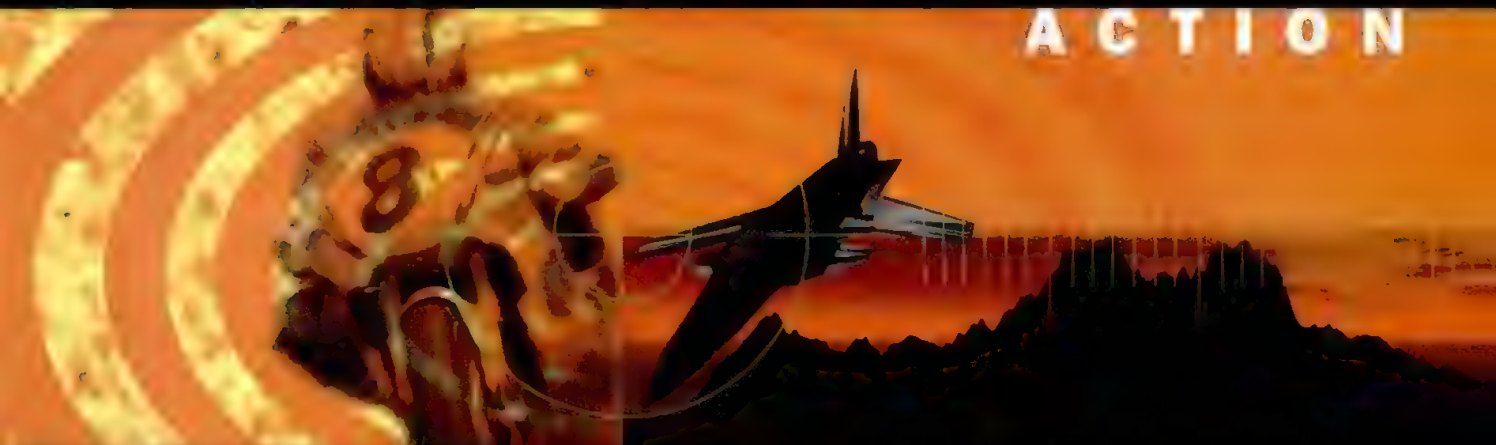
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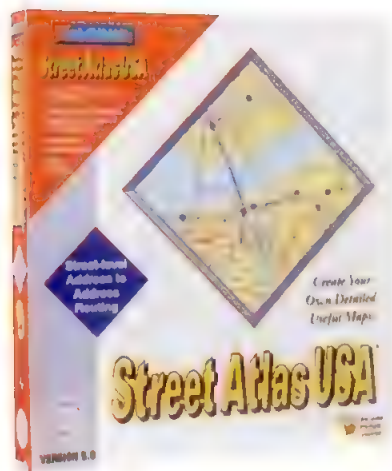
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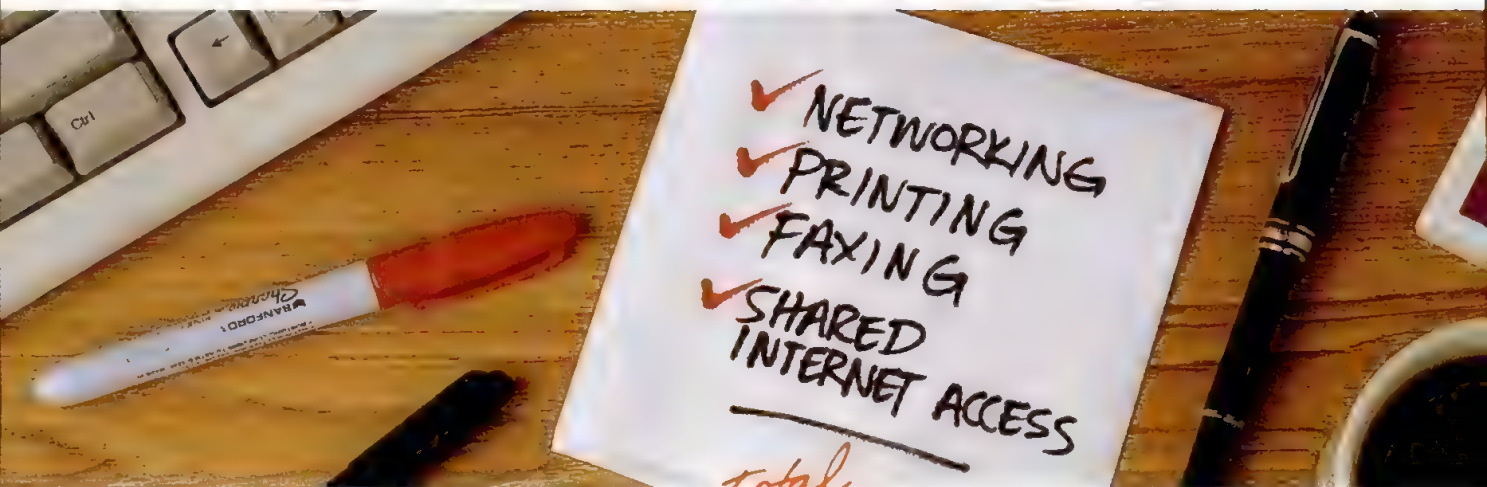
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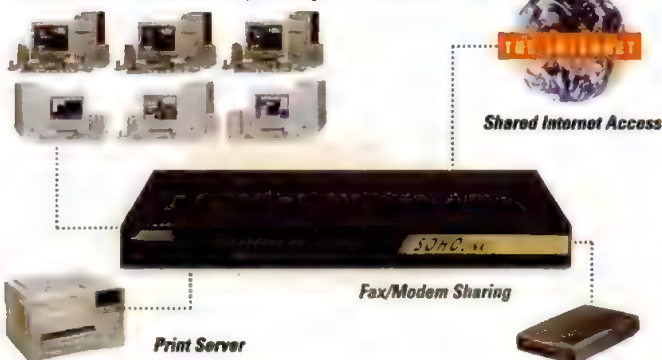
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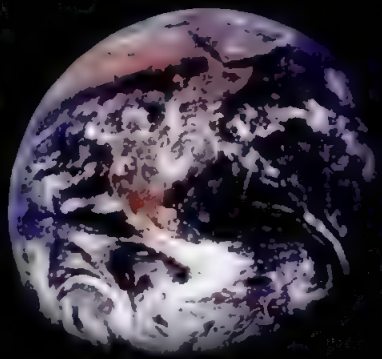
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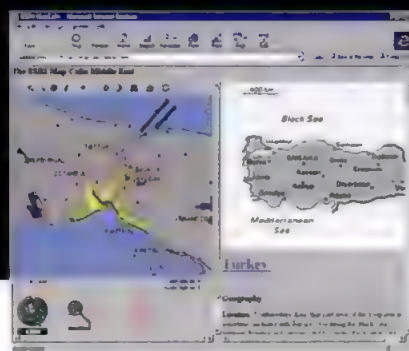
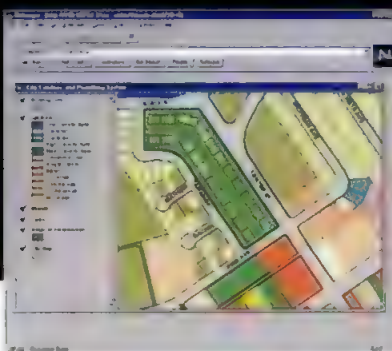
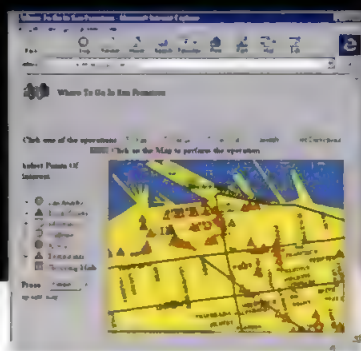
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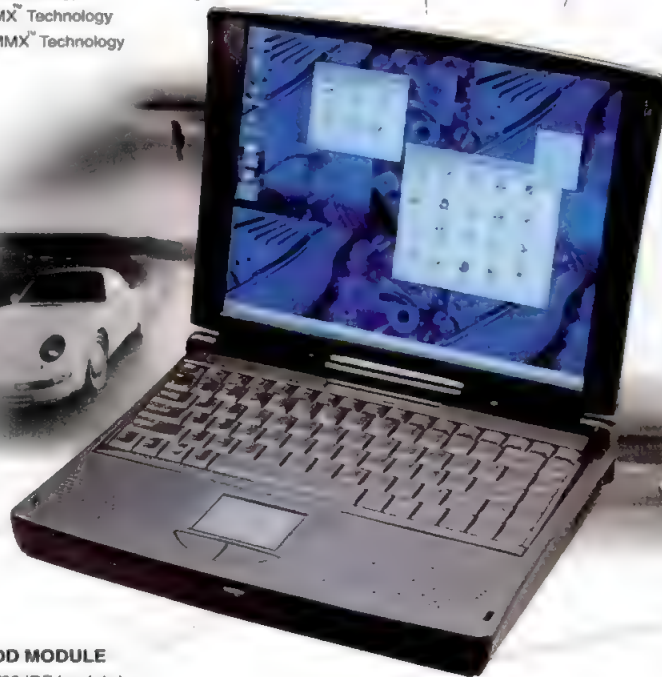
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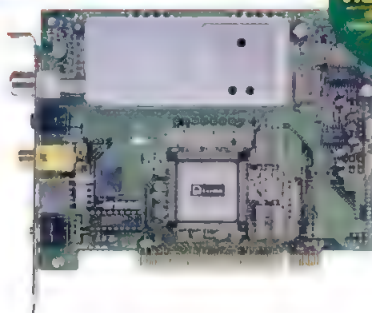
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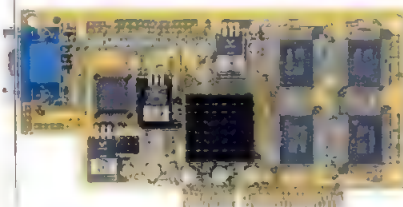


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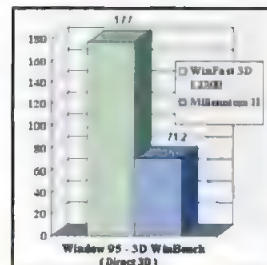
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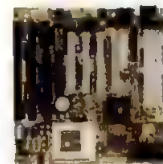
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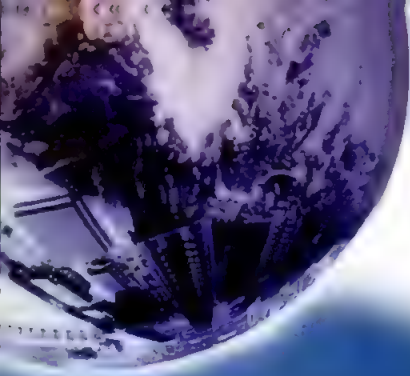
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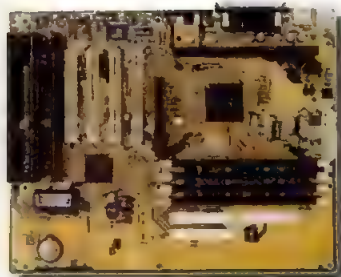
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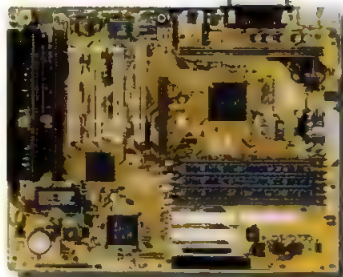
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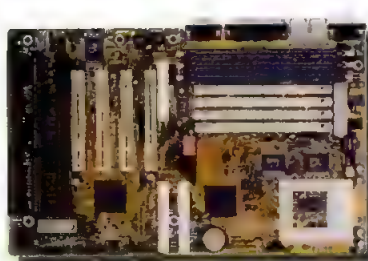
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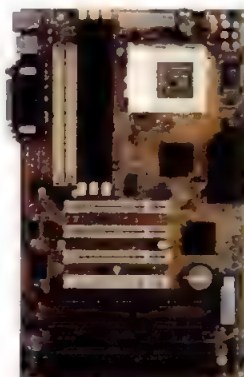
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Stark statistics illustrate the depth and breadth of Taiwan's role as "Supply Corps" to the world-wide computer revolution. Nearly one third of notebook computers manufactured during 1996 carried the made in Taiwan label — and booked orders indicate that figure is destined to rise in 1997. Desktop PCs? Same story, as many major branded computer makers turn to Formosa's factories for between a third and three-quarters of their annual sales volume. And when it comes to producing vital peripherals from monitors to mainboards and scanners to soundcards, Taiwan's market share verges on dominance.

Peripheral power

Taiwan's world market share

Hand-held scanners	95%
PC motherboards	74%
Mouses	65%
Keyboards	61%
Video cards	55%
Switching power supplies	55%
Monitors	53%
Desktop scanners	52%
Sound cards	50%
Modems	41%
LAN cards	39%
Graphics cards	38%



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IT'S VERY WELL MADE IN TAIWAN

What transformed Taiwan from an agricultural economy to a world high-tech leader? And can the same forces sustain the island's stunning growth into a new, fiercely competitive century?

Many of the public and private sector leaders - thinkers and doers who helped engineer past progress and who will help determine Taiwan's future — believe many of the answers to both questions are contained in the term Innovalue.

Innovalue is a new word that describes a not-so-new concept. A hybrid of innovation and value, Innovalue encapsulates Taiwan's unique gift for adding value to manufactured goods through innovation in product design and production processes. Innovalue helps explain today's Taiwan and charts a course for future successes.

"Innovalue," says Stan Shih, CEO of Acer, one of the world's Top Ten PC makers, "has opened the doors to Taiwan's past success. And as long as we continue to create value through innovation, Taiwan can drive the development of the IT industry."

Twinhead International President Dr. I.E. Lee agrees.

"Buyers look to Taiwan for value," he states. "Innovation in both product design and manufacturing processes is critical to creating state-of-the-art products customers want and can afford."

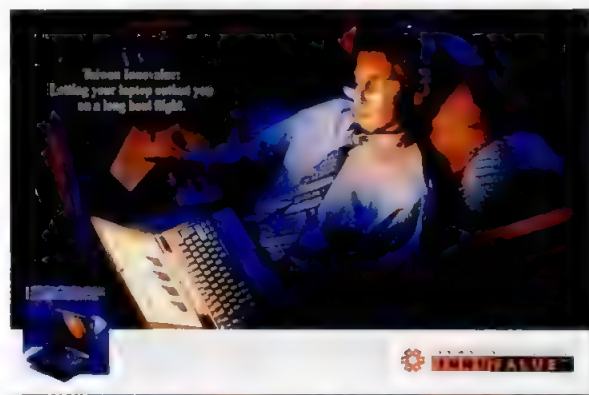
Trade officials like Ricky Y.S. Kao, secretary general of CETRA, Taiwan's quasi-governmental trade

promotion organization, goes a step further.

"Innovalue is Taiwan's niche in the global marketing sweepstakes. The concept of innovating to create value is vital for our continuing prosperity!"

A boon for consumers

"Taiwan's niche in world markets." "Impetus for an economic miracle." "Roadmap to future prosperity."



But it doesn't stop there. Innovalue is a boon and blessing to consumers around the world.

Nowhere is this more manifest than in the IT industry where a growing market share for Taiwan directly equates with an expansion of product features and an often dramatic rise in affordability.

Innovalue examples?

Begin with Acer, Taiwan's leading PC manufacturer. In 1993, video conferencing technology was available, but quirky and prohibitively expensive. A basic set-up cost \$20,000. By 1994 Acer Innovalue — a combination of design and manufacturing breakthroughs — had



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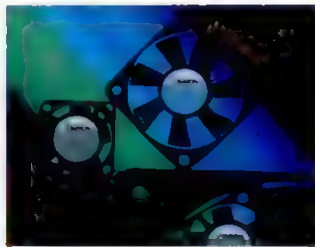
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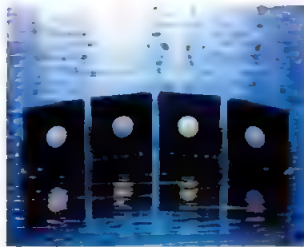
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slashed the cost to under \$2,000. Other makers are marketing under \$300 packages with \$200 video conferencing imminent.

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Or modems. Internet surfers demand speed. The 9,600 bps modem that once carried a US\$ 900 retail price tag were replaced by under US\$ 200 28,800 bps models that gave way to 33,600 bps devices for around \$190. Next 55,600 modems...

What transformed the Internet from molasses-slow text-based system to a multimedia Web of graphics and sound? No small part of the credit goes to Taiwan companies like E-Tech and GVC, the latter a relatively unknown company that claims to be the world's largest modem maker and sells its products under a dozen of the world's top brand names. And they're at it again — raising speed limits on that Information Superhighway by creating technology to make Integrated Service Digital Networks (ISDN) workable and affordable.

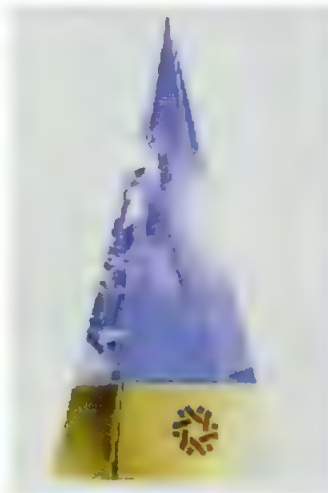
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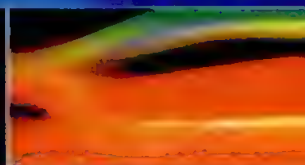
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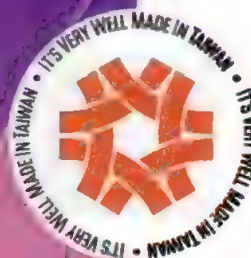
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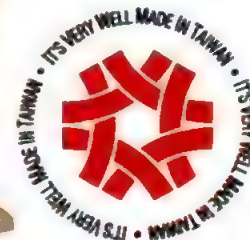
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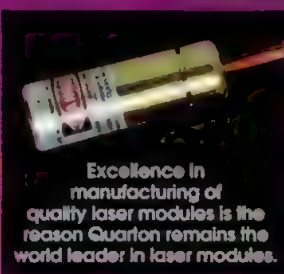
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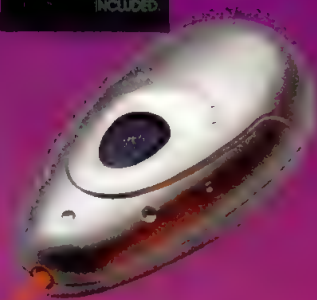


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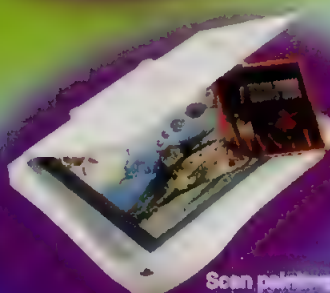
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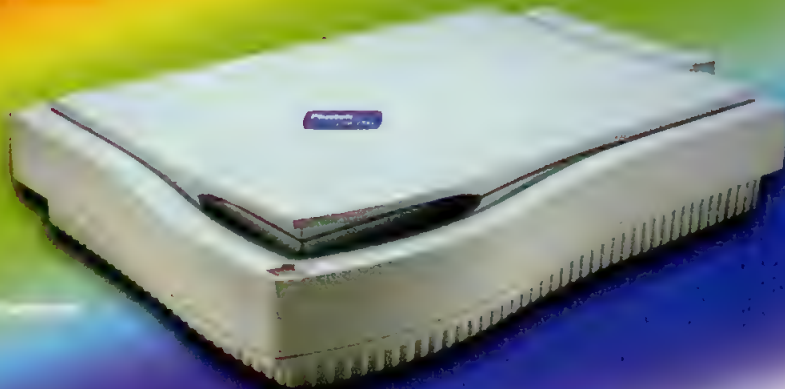
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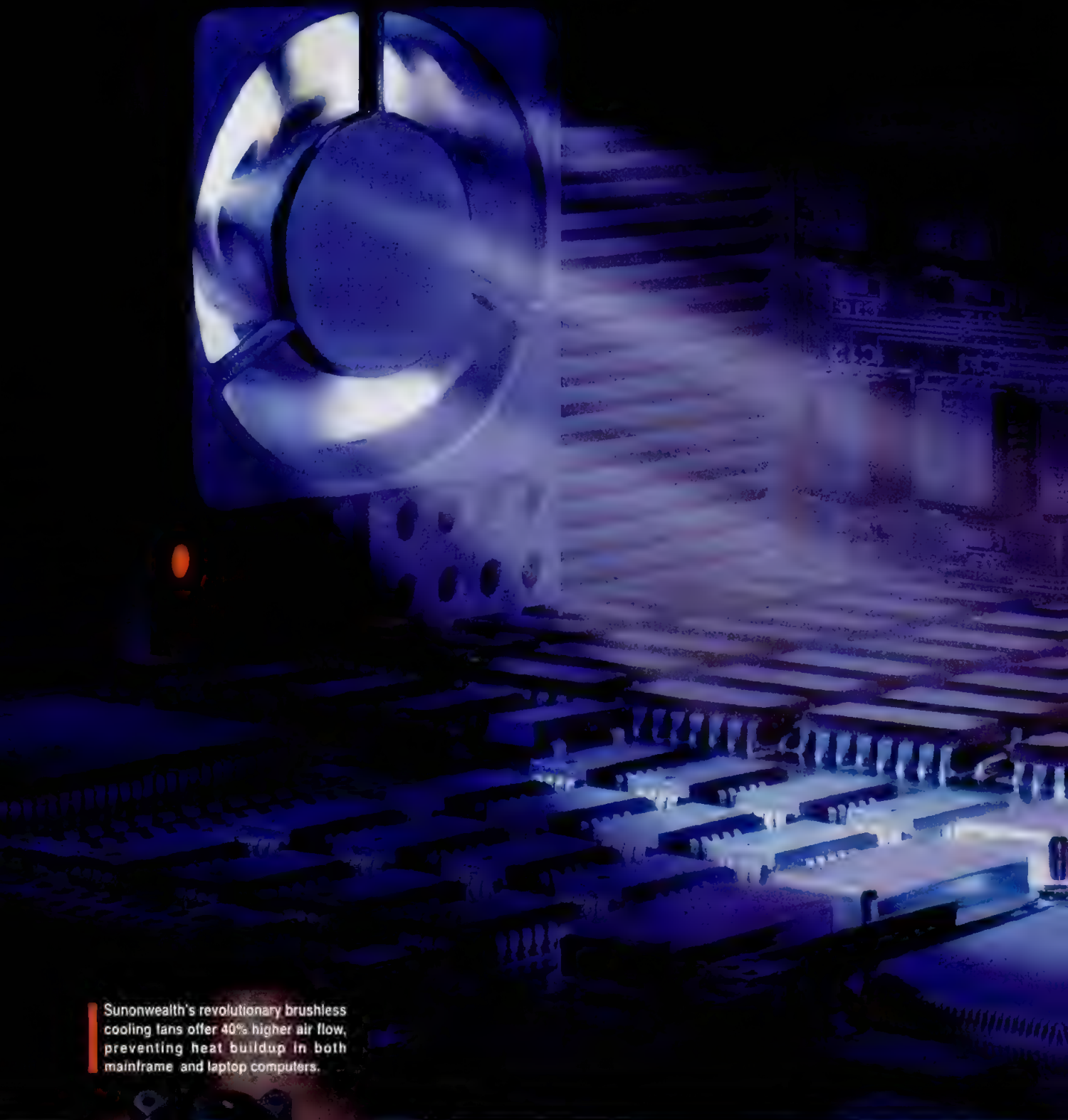
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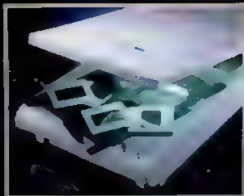
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User-to-User

BY NEIL J. RUBENKING

Link Browser Favorites to The Start Menu

I recently read about a way to open Internet Explorer's bookmarks in folder view, and I thought how nice it would be if this folder could be linked to the Start menu. Then you could add a bookmark in IE and have it automatically pop up on your Start menu, so you

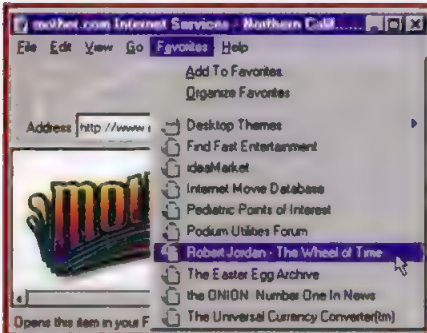


FIGURE 1: You can't tell by looking at it, but this menu's items are drawn from a submenu that resides in the Start menu.

could start IE on whatever page you liked! Here's how to do it in Windows NT 4.0 (and possibly Windows 95):

Create a folder in your Start menu directory for your bookmarks (mine is called WWW), and copy the contents of your Favorites folder into this folder. Now open the Registry Editor and navigate to HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\User Shell Folders. Change the data for the value named "Favorites" to say "%USERPROFILE%\Start Menu\WWW" (where WWW is whatever you named your folder). Close Regedit, and restart Windows (or just restart Explorer using the task manager in Windows NT).

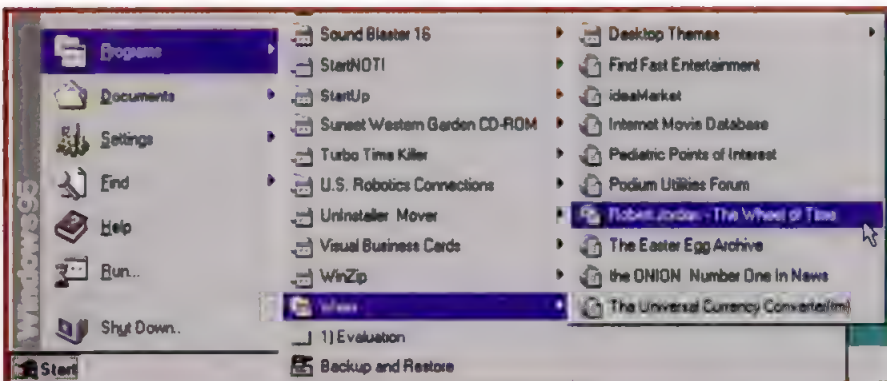


FIGURE 2: Items added to the Favorites menu in Internet Explorer can automatically appear in this submenu of the Start menu.

When you open Internet Explorer, the Favorites menu is now pointing to the folder in your Start menu, so the two menus will be forever dynamically linked!

JEREMY ROY
Boston, Massachusetts

PC MAGAZINE: This tip can be useful even if you don't want to link your IE3 bookmarks to the Start menu. The default location for the Favorites folder is not where you might expect, in Internet Explorer's own folder. It's in the Windows folder. If to conserve disk space on the Windows drive you installed IE3 on a different drive, it makes sense to store your bookmarks on the same drive as IE3. All you need to do is move the contents of the Favorites folder to a new location and enter the new location in the Registry.

Note that this same Favorites folder is used by other applications (Word, for example) to store shortcuts to often-used folders. By default the folder contains a link to the My Documents folder, along with any others that you've added. If you don't make use of this feature, you'll probably want to remove these folder shortcuts. They don't show up in Explorer's Favorites menu, but they clutter the corresponding submenu of the Start menu.

The technique shown here does indeed work in Windows 95 as well as Windows NT, with one change. The %USERPROFILE% variable is not available in the Windows 95 Registry, so you'll simply enter the full path of the new Favorites folder, for example C:\Windows\Start Menu\Programs\WWW. Figures 1 and 2 show Internet Explorer 3's Favorites menu and the corresponding submenu within the Start menu, after they've been synchronized.

Modifying File Associations in Windows 95

It always annoys me when I download an .EXE file from the Internet that turns out to be a self-extracting .ZIP file. The contents are dumped into the current directory, and I have to hunt the files down and move them before doing the installation. I would prefer to add an Unzip command to the right-click menu, but by default Explorer does not allow modifications to the Application file type.

To associate another operation with .EXE files in Windows 95, first make the following change in the Registry. Change the EditFlags key in HKEY_CLASSES_ROOT\exefile to 00 00 00 00. This change lets you add new associations for Windows 95 applications with Windows Explorer under View | Options | File Types.

Create a new action called unzip and associate it with your Windows 95 Unzip program. Note that this does not work with the unregistered version of PKZip for Windows 95. As always, remember to back up your Registry before you make any changes.

JIM PRUMOS
via the Internet

PC MAGAZINE: The usual way to add or modify associations for a given file type involves going through Explorer's View | Options dialog. You click on the File Types tab, choose the type you want to change, and press the Edit button. This launches the Edit File Type dialog, which allows you to add, remove, or edit the actions associated with the file type. You can also change the default action (the action that's triggered by double-clicking a file of this type).

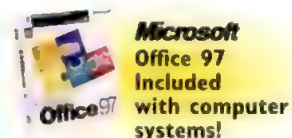
If you select Application in the list of file types, however, you'll find that the Edit and Remove buttons are disabled. That's for your own protection—if you removed the application file type or mangled its associations, you might disable Windows 95's ability to launch programs. If you try selecting the file type named MS-DOS Batch File, the Edit button is enabled but Remove is disabled. When you press Edit, you'll find that you cannot remove any of the three existing actions (edit, open, and print) and you cannot change the default action. You can, however, add new actions.

All of the information displayed in the Edit File Type dialog comes from the Registry, and the changes you make are recorded in the Registry. Naturally the source of the restrictions on editing the associations for certain

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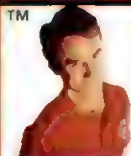
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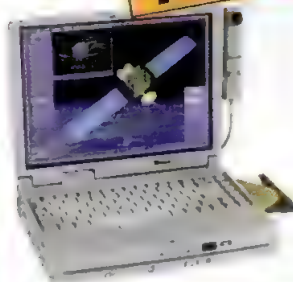
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Mini-tower	CPU	RAM	Hard drive	CD-ROM	Price	CDW
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8034	200MHz Pentium MMX	32MB/128MB	2.1GB	16X Max	-	\$1419.35	95055
8037	233MHz Pentium MMX	32MB/128MB	3.2GB	24X Max	-	\$1649.54	95056
Tower	CPU	RAM std./max.	Hard drive	CD-ROM	Modem	Price	CDW
8172	166MHz Pentium MMX	16MB/192MB	2.1GB	16X Max	56K bps	\$1379.29	95057
8174	200MHz Pentium MMX	32MB/192MB	2.1GB	24X Max	56K bps	\$1635.54	95058
8177	233MHz Pentium MMX	32MB/192MB	4GB	24X Max	56K bps	\$1869.90	95060
8178	233MHz Pentium MMX	32MB/192MB	6GB	24X Max	56K bps	\$2117.37	95061

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5230D	233MHz Pentium MMX	32MB	3GB	24X	\$1798.36	95209
6230D	233MHz Pentium II	32MB	3GB	24X	\$2199.43	95208
Mini-tower	CPU	RAM	Hard drive	CD-ROM	Price	CDW
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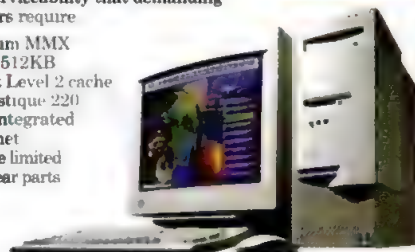
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233MHz Pentium MMX	32MB	4.2GB	24X	\$1859.29	95759
Mini-tower	RAM	Hard drive	CD-ROM	Price	CDW
166MHz Pentium MMX	32MB	2.5GB	-	\$1369.09	95762
200MHz Pentium MMX	32MB	4.2GB	24X	\$1699.64	95763
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IBM PC Server 315

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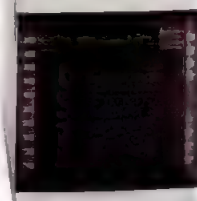
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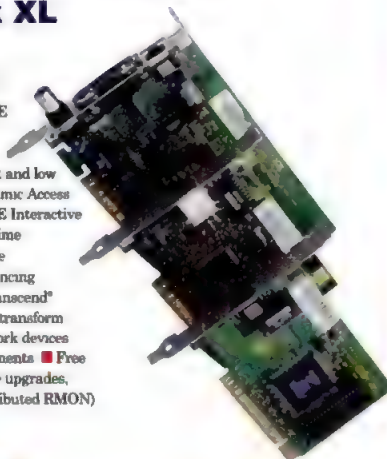
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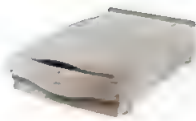
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types is also found in the Registry. Launch the Windows Registry Editor (Regedit.exe) and open the key named HKEY_CLASSES_ROOT. This key has a large number of subkeys whose names represent file extensions—.AVI, .BAT, and .CUR, for example. The default value for each of these subkeys is the internal name of the corresponding file type—avifile, batfile, curfile. Each of these internal names matches another subkey of HKEY_CLASSES_ROOT, and the file type information is recorded in this internal name subkey.

Each of the internal name subkeys can have a value (shown in Regedit's right-hand pane) named EditFlags. This 32-bit binary value defines any restrictions on editing the particular file type using Explorer. The specific significance of each bit is not documented, but by setting the value's data to 00 00 00 00, you remove all restrictions. It's important, though, to write down the original value and restore it after you've made your changes. The EditFlags value exists to protect you from making disastrous errors that could disable your whole system; accepting that protection is only sensible!

Using MODE to Generate Line Fragments

There are several awkward ways to generate the line fragments (lines without CR/LF endings) needed to make batch file processing of lines or lists practical. One easier way is to use the MODE command. If MODE is supplied with an improper argument (i.e., not a device name), it will generate an error message that is actually a line fragment. MODE is the only DOS command I know of that outputs line fragments. This error line can be concatenated with any data line to create a useful batch file. Consider this example, which might be used to process a URL file passed as an argument:

```
mode X> temp.bat
type %1 | find "URL=" >> temp.bat
```

In this example, MODE's error message will be Invalid parameter - X, and the output of the FIND line would be something like URL=http://www.zdnet.com. This would result in a TEMP.BAT file containing the line

```
Invalid parameter - XURL=http://www
.zdnet.com.
```

All you need at this point is an INVALID.BAT that references %4 to isolate the specific URL.

MODE has other uses too. It attempts to derive a device name from any argument you

supply, usually the first word before any punctuation. For example, the command C:\mode test.txt results in the line Invalid parameter - test, while C:\>mode c:\test.txt yields Invalid parameter - c. If you redirect the MODE line to a batch file, that batch file can be CALLED to run an INVALID.BAT that could reference %3 to allow processing of the data. This is one of the easier ways available to isolate a drive letter or filename.

ERIC PHELPS
Sacramento, California

PC MAGAZINE: In batch file programming it's often necessary to prefix the first line of a file with a particular command or word. This is accomplished by creating what Mr. Phelps calls a "line fragment" and then using COPY to append the file to it. Creating such line fragments under program control is not easy. The

```
@ECHO OFF
:: ALLFILES.BAT - demonstrates a
:: technique for processing all
:: files matching a template in
:: and below a specified directory
MODE => FIL$1.$
DIR %1 /B/S > FIL$2.$
ECHO SET ThisFile=%3> INVALID.BAT

:Loop
COPY FIL$1.$+FIL$2.$
FIL$$$BAT>NUL
CALL FIL$$$BAT
IF "%ThisFile%"==" " GOTO
OutOfLoop
:: Insert actual file-
:: processing code here
ECHO Processing "%ThisFile%"
TYPE FIL$$$BAT | FIND ":\" |
FIND /v "Invalid parameter -" >
FIL$2.$
GOTO Loop

:OutOfLoop
DEL FIL$?.*
DEL INVALID.BAT
```



FIGURE 3: This batch file uses a line fragment generated by MODE to aid in processing a list of files.

ECHO command ends each line with a carriage return and line feed, so it's not helpful. Batch files can create and execute a DEBUG script that will in turn create the line fragment, but this is dreadfully complex. You could create the line fragment by hand and store it permanently in your batch file directory, but you'll be expending a full cluster of disk space

to do so. This quirk of the MODE command provides an excellent way to generate line fragments on demand.

You can use virtually any incorrect parameter to make the MODE command generate a line fragment, but the equal sign is an especially good choice. In processing batch file parameters, COMMAND.COM treats the equal sign as a separator, just like a space or tab character. Thus, when your temporary batch file calls your version of INVALID.BAT, the equal sign will be ignored.

To demonstrate this technique, I wrote ALLFILES.BAT (Figure 3), a batch file that processes all files matching a template in and below the specified directory. The only "processing" it does is to report the filename, but naturally you can modify it to do more. Called with no parameters, ALLFILES reports all files in and below the current directory. Give it a template like *.BAK and it reports all matching files in and below the current directory. And if the template includes a starting directory such as D:*.TXT, it will report all matching files in and below that starting directory.

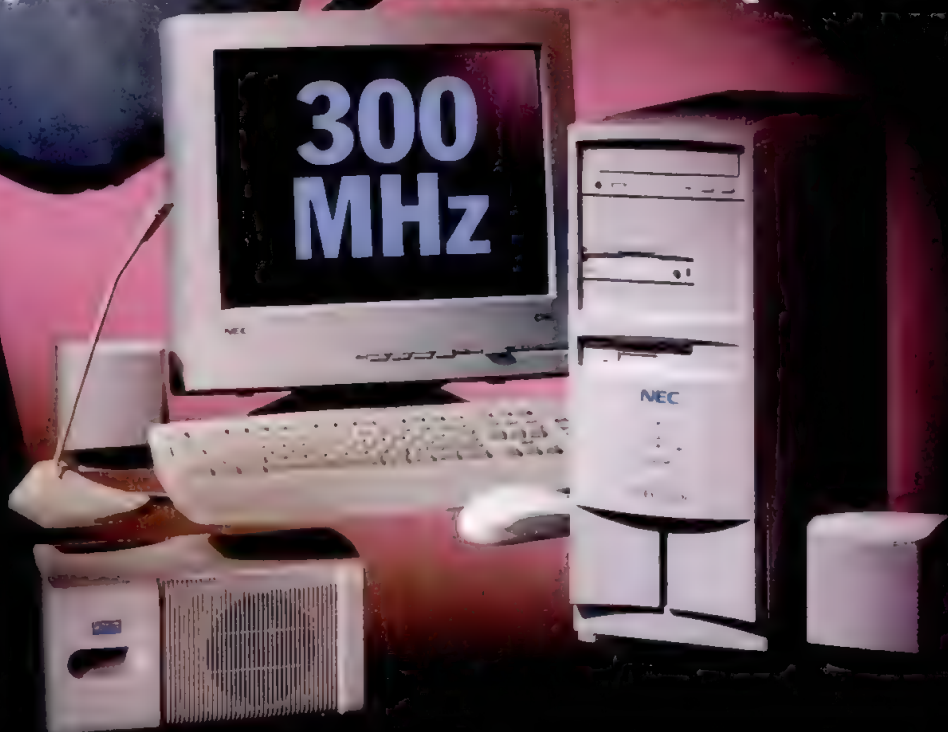
ALLFILES starts by creating FIL\$1.\$, a line fragment containing just the string Invalid parameter - =, with no carriage return or line feed. Then it uses the DIR command switches /B and /S to generate a list of matching files with full pathnames, which it stores in FIL\$2.\$. It creates INVALID.BAT as well, containing the single line SETThisFile=%3. Note that the doubled percent sign in ALLFILES.BAT is converted to a single percent in INVALID.BAT.

With all files in readiness, the batch file enters a loop. It appends FIL\$2.\$ to FIL\$1.\$ and stores the result in FIL\$\$\$BAT. Then it launches FIL\$\$\$BAT using the CALL command. The first line of FIL\$\$\$BAT transfers control to INVALID.BAT, passing the first filename. And INVALID.BAT sets the environment variable ThisFile to the passed filename. ALLFILES.BAT can now perform any necessary processing on the file.

ALLFILES.BAT now strips off the first line by using the FIND command's /V switch to find only lines that do not contain the string Invalid parameter -. The result of this command is stored back to FIL\$2.\$, and the loop goes around again. Eventually FIL\$2.\$ will be empty, and INVALID.BAT will set the ThisFile environment variable to the empty string. At that point, the loop terminates and ALLFILES.BAT cleans up its temporary files.

I'm sure you'll find many other uses for the line fragments produced by the MODE command. But don't wait around to try it; this feature is undocumented, and it could disappear with the next version of DOS.

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HARDWARE

Platter Publishing

I have written a program that I want to publish on CD, and I'd like to use a CD recorder. I figure that I may sell 100 to 750 copies per year; would it be practical to produce these on a standard CD-R drive?

DAVID DAUGHERTY
via the Internet

PC MAGAZINE: A CD-R drive should be ideal for your needs. A 2X recorder takes a little more than a minute to burn 10MB of data, so a fairly full CD should take less than an hour. There are also 4X CD-R drives that cut those times in half. If you're burning three or four CDs a day, either type will handle the load with relative ease.

To dress up your product, you can get adhesive labels that you can print on with your laser or ink jet printer and apply to your CD-R disks. There are also new ink jet printers that can print onto CD-R disks, for a professional look. You can even buy a system that includes both the CD recorder and a printer with a mechanical disk-handling system that completely automates CD publishing.

There are some reasons you may not want to use CD-R, however. The initial DVD drives cannot read CD-R disks reliably, so if these drives become widely accepted before the problem is resolved, users may have difficulty reading your software. Also, short-run publication of CD-ROMs is not as expensive as it used to be. Some vendors advertise rates as low as \$1 per disk, including a two-color label and packaging. Your 750-piece annual production run could cost less than just the CD-R printer, so unless you need the ability to make changes to the software as you go, you may want to let someone else produce your platters.—*Alfred Poor*

A Broader View

I have used the horizontal-size controls on my monitor to expand the image as wide as it will go, but the image still doesn't cover about half an inch on each side. I'm running Windows 95; is there any way that I can increase the width?

RALPH SMITH
via the Internet

PC MAGAZINE: The cause of the problem is a timing mismatch between the monitor and

the signal produced by your graphics adapter. An internal adjustment by a technician could do the trick, but you should be able to solve this one on your own.

The first step is to go to your Display Properties screen. (You can get there through the Control Panel or with a right-click on an empty space on your desktop, which will pop up a menu with the choice *Properties*.) Once in the dialog, choose the *Settings* tab and then the *Change Display Type* button. Make sure that you have the correct graphics adapter and monitor selected. If not, click *Change Display Type* and use the *Change...* button to open a window where you can make the proper selection.

If you have the correct hardware configuration, then the problem is most likely that the vertical scan rate (the refresh rate) is set too high for the monitor. If your graphics adapter has a Windows utility that lets you specify the refresh rate, try choosing a lower setting. Some older graphics adapters use a DOS utility to configure the cards' settings to work with different monitors.

If you don't have access to the refresh rate, then try choosing a different graphics adapter, such as the Standard SVGA driver, and see whether that works better. It may have less ambitious scan-rate settings than your card's driver, but it won't take advantage of acceleration features that your graphics board may offer, in which case you'll have to choose between performance and image size.

—*Alfred Poor*

OPERATING ENVIRONMENTS

A New Clock for OS/2 Warp

I've heard that you can change the appearance of the clock in OS/2's WarpCenter. Is this true, and if so, how do I do it?

GEORGE MARRIOT
via the Internet

PC MAGAZINE: Yes, it is true. Figure 1 shows the old clock above and the new one below. It's easy to make the change. Just add the following line to your config.sys file:

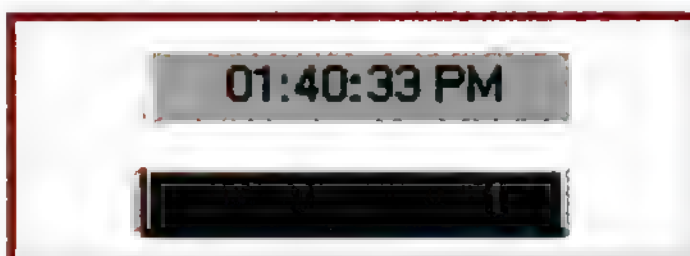


FIGURE 1: You can substitute a new clock (bottom) for Warp's old clock.

SET SCUSEPRETTYCLOCK=ON

The "SC" is for SmartCenter. When IBM acquired Lotus Development Corp., it took the SmartCenter that Lotus included with its applications and embedded it in OS/2 Warp as the WarpCenter.—*Brian Proffit*

WORD PROCESSING

Printing Selected Labels From a Merged Document

Merging labels to a document lets you create a reusable mailing list—for multiple mailings to clients, for example. But if you use Microsoft Word 97 and have enough addresses to fill more than one label sheet, you'll run into a problem if you want to print selected pages from the merged document. If you give a command to print pages 4 through 8, for example, nothing will print, because each page is numbered as page 1.

Word 97 inserts section breaks between pages, and it formats each section to start at page 1. To print a range of pages, you have to specify sections. To print pages 4 through 8,

OUR ADVISORS

Alfred Poor is a contributing editor and the author of *The Underground Guide to Hardware*.

Brian Proffit is a contributing editor of *Computing Today* and the author of *OS/2 Warp Survival Kit*.

Sal Ricciardi is a contributing editor and the author of the *Running Fox-Pro* series from Microsoft Press.

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Craig Stinson is a contributing editor and the coauthor of *Running Windows 3.1* and *Running Microsoft Excel*.

M. David Stone is a contributing editor and the coauthor of *Word for Windows Companion, Second Edition*.

PCTech Ask Our Advisors

choose **File | Print**, choose **Pages in the Page Range** box, and enter:

```
pls4 - pls8
```

This translates to page 1, section 4 through page 1, section 8. Having to specify sections seems an unnecessary complication, but it's easy enough once you know how.

ANDREW TEMTE
via PC Magazine Online

PC MAGAZINE: There are at least two other ways to print a range of pages from the merged document. You can select from the start of the first page you want to print to the end of the last page to print, then choose **File | Print**, then **Selection**. You'll find it easier to select the right pages if you first use the **View | Zoom** command to set zoom size to 10 percent, so you can see as many pages as possible.

Another choice is to remove the section breaks. You can use the **Edit | Find** command to search for section breaks by entering ^b in the Find What box, then delete each break manually as Word finds it. (Word won't let you delete breaks with the **Edit | Replace** command.) Before you delete them, however, be aware that there's at least one good reason to keep section breaks instead of relying on automatic page breaks.

Word creates label formats with tables, using one cell for each label. Unfortunately, if you want to print a section of a table that spans a page break, you can run into a problem. If you select, say, the last row on one page and the first row on the next, you may not have the option of printing the selection, depending on how you selected it.

If you select one or more cells in each row and then choose **Table | Select Row** (or select the rows by clicking and dragging in the area to the left of the leftmost column), you can choose **File | Print** and then tell Word to print the selection. But if you start with the cursor in the leftmost cell of the first row, then extend the selection with mouse or keyboard to the end-of-row marker in the second row, Word will gray out the option to print the selection. On the other hand, if you replace the page break with a section break, you can use any approach to selecting text and still print the selection. Inserting a section break in merged labels automatically sidesteps a potential source of confusion and frustration.

Be aware that Word 6 and Word 7 do not, by default, reset the numbering to page 1 in a merged document. That means you can specify page numbers instead of sections when you want to print a range of pages. Only Word 97 sets the page number to 1 at

the beginning of each new section.

A more important difference among versions is that Word 6 and Word 7 insert continuous section breaks, but Word 97 inserts section breaks that force new pages (except for the last section break in the merged document). That means if you select, say, two rows of labels that span a section break in Word 6 or 7 and then print the selection, your selection will print as the first two rows on a single label sheet. If you try the same thing in Word 97, the second row will start on a new label sheet. To convert the section breaks to continuous format in the merged document in Word 97, choose **File | Page Setup**, then **Layout**. Set the Section Start box to **Continuous**, set the Apply To box to **Whole Document**, and choose **OK**.

Finally, it's worth giving a brief description of how to create labels through a merge, for those who aren't familiar with Word's Merge Labels feature. To keep this example short, I'll assume you've already created a data file using a table in a Word document. The first row of the table should contain the field names—Title, FirstName, LastName, and so on. Each additional row should hold information for one record, with the fields in columns under the appropriate field names. I'll also assume that you want to print a label for each entry, print in the same order as the entries in the data file, and print to an Avery label format.

When you've created the data file, start with a blank document and choose **Tools | Mail Merge, Create | Mailing Labels**, and then **Active Window** to designate the document you started from as the main merge document. Next choose **Get Data | Open Data Source** and specify the data file to use.

Word will then suggest you choose the **Set Up Main Document** button. Click on it to open the Label Options dialog box. Specify dot matrix for tractor-feed labels or laser for label sheets, pick from the list of labels, and choose **OK** to open the Create Labels dialog box. For each field, place the cursor where you want it, choose **Insert Merge Field**, and pick a field name from the list. When you're done, choose **OK**, then **Merge**, make sure

Merge To is set to **New Document**, and choose **Merge** again. Word will create a new document for the labels, complete with section breaks.—M. David Stone

SPREADSHEETS

Font Lists in Excel

Like many, I've accumulated a lot of TrueType fonts over the years, and it's time for me to organize them (and to delete the ones I'm not likely to use). What I'd like is a Microsoft Excel or Word macro that would automatically create samples of all my fonts. Ideally, each font name would be in Times Roman with a sample beside it—one line per font. Can you help?

JON COHEN
via the Internet

PC MAGAZINE: Excel's object model doesn't include a font-name collection, so there's no simple way to generate this table using Excel alone. If you have Word on board, however, you can do the job with the help of OLE Automation and Word's object model. The following code in Figure 2 does the trick.

The code's first line turns the Word application into an object variable, letting the rest of the code make use of Word's object model, including its FontNames collection. The **For**

```
Sub PrintFontList()  
Set Word = CreateObject("Word.Application")  
For Each Font In Word.FontNames  
With ActiveCell  
.Value = Font  
.Offset(0, 1).Font.Name = Font  
.Offset(0, 1).Value = "The quick brown _  
fox jumps over the lazy dog."  
End With  
ActiveCell.Offset(1, 0).Activate  
Next  
With ActiveCell  
.EntireColumn.AutoFit  
.Offset(0, 1).EntireColumn.AutoFit  
.Sort Key1:=ActiveCell  
End With  
End Sub
```



FIGURE 2: This Visual Basic for Applications macro produces a list of your system's fonts with sample text for each font. It invokes the help of OLE Automation and Microsoft Word's object model.

Each loop then puts each font name (in Excel's default font) in one column and a sample in the corresponding cell of the neighboring column. The code following the **For Each** loop simply sorts the resulting table, so that your fonts appear alphabetically, and auto-fits the second column so that Excel doesn't truncate your font samples on-screen.

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Note that Word does not have to be running; it only has to be present.

The macro doesn't concern itself with whether data is lying in its way, so be sure you execute it in a blank area of your worksheet.

—Craig Stinson

DATABASES

Preventing Multiple Instances

Microsoft Access lets you run more than one instance of the program at the same time. As a developer, I don't want users to run more than one copy of my custom Access application at a time, but I also don't want to prevent them from running other Access applications. Coming up with code to deal with this in Microsoft Access 97 was a little more difficult than I thought it should be.

My solution depends on the fact that the desktop window in Win32 is the parent window of all the top-level application windows in the system. The window handle for the desktop window is easily obtained by a call to the GetDesktopWindow API function, and you can use this handle to access the handles of all the child windows through calls to GetWindow. Once a handle is known, the API function GetWindowText returns the window caption (for those windows that have captions).

Finally, my custom database application is given a unique name by selecting the Tools menu, choosing Startup, and editing the application title. Access places the title in the caption of the main Access window when the application is run. I can then compare the window captions of all available windows against my application title to see whether any additional instances of my application are running.

The function can be added to any database and used to see how many copies of a particular database are already open.

GYL MIDRONI
Toronto, Canada

PC MAGAZINE: Mr. Midroni's original code filled an array with the top-level window names obtained from all of the windows currently available on the system. It then searched that array and counted the number of names that matched the database's application title. Although this is a valid technique, I took a slightly different approach.

First I decided to match on both window caption and window class name. Every window belongs to a window class, so matching on both class and caption helps reduce the possibility that another application could have the same window caption and be count-

ed in error. I also decided to generalize the code to accept the class name and window caption as function arguments and return a count of the open top-level windows that match. The resulting function, CountWindows, is available for downloading from PC Magazine Online.

In Windows, every window is a member of a window class. The window class for the main Access window in Microsoft Access is 0Main. Other applications have their own class names. For example, the window class name for Excel 97 is XLMAIN, and the Window class name for Word 97 is OpusApp.

To check for a running Access application, you would call CountWindows from your code using "0Main" as the first argument and your application title as the second argument. Remember that the returned count includes your currently running application.

The code in CountWindows does a strict comparison on the window class name, so the class name passed to the function must exactly match the class name returned by Windows. The comparison on the window caption works a little differently, however. The code compares only as many characters as exist in the window caption you pass to the function. That means you can search for a match on the characters that remain constant in a caption that changes based on the application's state. For instance, an Access application with a maximized form will have a caption that consists of the application title followed by the name of the form, such as Sales Application - [Customers]. If the form is not maximized, on the other hand, only the application title will appear in the caption, and not the form name. Because the window title can vary, we can't just use the simpler FindWindow function, which requires an exact match. The CountWindows function compares only as many characters as you pass in the name argument, so you can use the application title—Sales Application—and the function will record a match in either instance, because the leftmost characters remain the same. Note that the text to be matched must precede any other text in the caption.

For example,

```
CountWindows("0Main","Northwind")
```

would match Northwind, Northwind Traders, or Northwind - [Customers] but not Microsoft Access - Northwind.

Another consequence of the manner in which the caption is compared is that you can pass an empty caption as the second argument. In that case the function returns a count of all windows of the specified window class.

For example, CountWindows("0Main", "") will return a count of all open windows belonging to the 0Main window class, regardless of the contents of the window captions. Thus if you have three Access applications running, the function will return 3.

Mr. Midroni's original code as well as the CountWindows function can be found in the Access database named Cntwnd.mdb on PC Magazine Online.—Sal Ricciardi

Initializing Fields in Queries

I have an Access database in which I run a make-table query followed by an append-table query to create a new table. I want to set the value of a certain field to 1 when the record is copied into the table through the make-table query, and to 2 when it is copied through the append-table query. How would I go about this?

STEVEN GOODRICH
via the Internet

PC MAGAZINE: Although it doesn't seem to be documented anywhere, you can use the colon operator to assign a constant value to a column in your select list. For example, to initialize a column named Status to 1, you enter *Status:1* in the Field cell in the query design grid. When you run the query, the Status field will be set to 1 in every row in the result.

The colon operator works when you're in design view. If you switch to SQL view, however, Access will use a different syntax—for instance, it will translate the "Status:1" in the design grid to "1 as Status" in your SQL statement. So if you type your queries directly into SQL view, you'll have to remember to use the "1 as Status" format.—Sal Ricciardi

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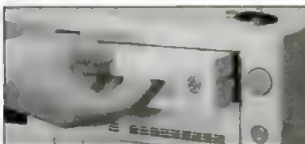
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1281MB	5200	Western Digital	AC11200	\$152
1624MB	5200	Western Digital	AC21600	\$158
1700MB	4500	Seagate	ST31720A	\$148
1750MB	5400	Fujitsu	MPA3017A	\$148
2000MB	4500	JTS	JTS2000	\$170
2000MB	5200	Western Digital	AC22000	\$177
2132MB	4500	Seagate	ST32132A	\$170
2500MB	5200	Micropolis	MC4525A	\$179
2557MB	4500	Seagate	ST32531A	\$199
2559MB	5200	Western Digital	AC22500	\$195
3000MB	4500	JTS	JTS3000	\$199
3166MB	5200	Western Digital	AC3100	\$208
4000MB	5200	Western Digital	AC34000	\$243
4000MB	5200	Micropolis	MC4540A	\$224
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2275MB	7200	Quantum	VK32275S	\$335
3228MB	5400	Quantum	FB3240S	\$290
4300MB	5400	Micropolis	MC4743	\$319
4310MB	5400	Quantum	FB34320S	\$319
4400MB	7200	Fujitsu	M2954S	\$539
4550MB	7200	Micropolis	MC4345	\$515
4550MB	7200	Micropolis	MC4345AV	\$569
4550MB	7200	Seagate	ST34572N	\$577
4550MB	7200	Quantum	VK34550S	\$505
4550MB	7200	Quantum	XP34550S	\$608
4550MB	10,000	Seagate	ST34501N	\$665
6448MB	5400	Quantum	FB34400S	\$437
9100MB	7200	Micropolis	MC3391	\$855
9100MB	7200	Fujitsu	M2949S	\$889
9100MB	7200	Quantum	XP39100S	\$913
9100MB	7200	Micropolis	MC3391AV	\$919
9100MB	7200	Seagate	ST19171N	\$935
9100MB	10,000	Seagate	ST19101N	\$1079
23300MB	5400	Seagate	ST423451N	\$1799

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2275MB	7200	Quantum	XP32275W	\$299
4300MB	5400	Micropolis	MC4743W	\$329
4400MB	7200	Fujitsu	M2954W	\$550
4550MB	7200	Micropolis	MC4345W	\$535
4550MB	7200	Micropolis	MC4345WAV	\$589
4550MB	7200	Seagate	ST34572W	\$615
4550MB	7200	Quantum	VK34550W	\$505
4550MB	7200	Quantum	XP34550W	\$608
4550MB	10,000	Seagate	ST34501W	\$699
9091MB	5400	Micropolis	MC3391W	\$875
9091MB	5400	Micropolis	MC3391WAV	\$935
9100MB	7200	Fujitsu	M2949W	\$919
9100MB	7200	Quantum	XP39100W	\$919
9100MB	7200	Seagate	ST19171W	\$959
9100MB	10,000	Seagate	ST19101W	\$1100
23300MB	5400	Seagate	ST423451W	\$1859

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UWD	RPM	Brand	Model	Price
2160MB	7200	Seagate	ST32272WD	\$455
4550MB	7200	Seagate	ST34572WD	\$632
4550MB	10,000	Seagate	ST34501WD	\$759
9100MB	7200	Seagate	ST19171WD	\$1029
23200MB	5400	Seagate	ST423451WD	\$189
SCA	RPM	Brand	Model	Price
2160MB	7200	Seagate	ST32272WC	\$419
4550MB	7200	Seagate	ST34572WC	\$629
4550MB	10,000	Seagate	ST34501WC	\$719
9100MB	7200	Seagate	ST19171WC	\$969
9100MB	10,000	Seagate	ST19101WC	\$1120
FC-AL	RPM	Brand	Model	Price
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	24X	Teac	CD524E	95	\$92
	24X	Panasonic	CR585	85	\$94
	24X	Pioneer	DRX24X	75	\$95
	24X	Mitsumi	CRMCP24X	90	\$96
	24X	Toshiba	XM6102B	85	\$99
	32X	Teac	CD532E	84	\$115

IDE CD CHANGERS

Speed	Brand	Model	# Disks	Int
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8X	NEC	CDR4X8	4	\$105
12X	Panasonic	SQTC512N	5	\$266

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SCSI CD ROM

Speed	Brand	Model	ms	Int
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12X	Plexstor	PX12CS(caddy)	105	\$259
15X	Toshiba	MX3801B	99	\$145
16X	NEC	CDR1610	100	\$135
30X	Plexstor	PX20TS	95	\$219
24X	NEC	CDR1810	85	\$155
32X	Teac	CD532S	85	\$169
32X	Plexstor	tray or caddy	85	\$Call

SCSI CD CHANGERS

Speed	Brand	Model	# Disks	Int
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SureStart 7110 includes 1 disk \$419
External for parallel printer port (C4366A) \$519
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Internal IDE (CDU928S) \$349*
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3228MB	10ms	5400	FB33240A	3	\$212
4310MB	10ms	5400	FB34320A	3	\$249
6448MB	10ms	5400	FB36480A	3	\$346

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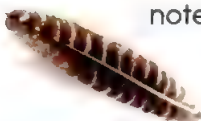
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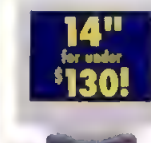
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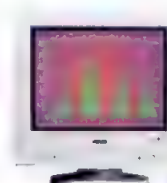
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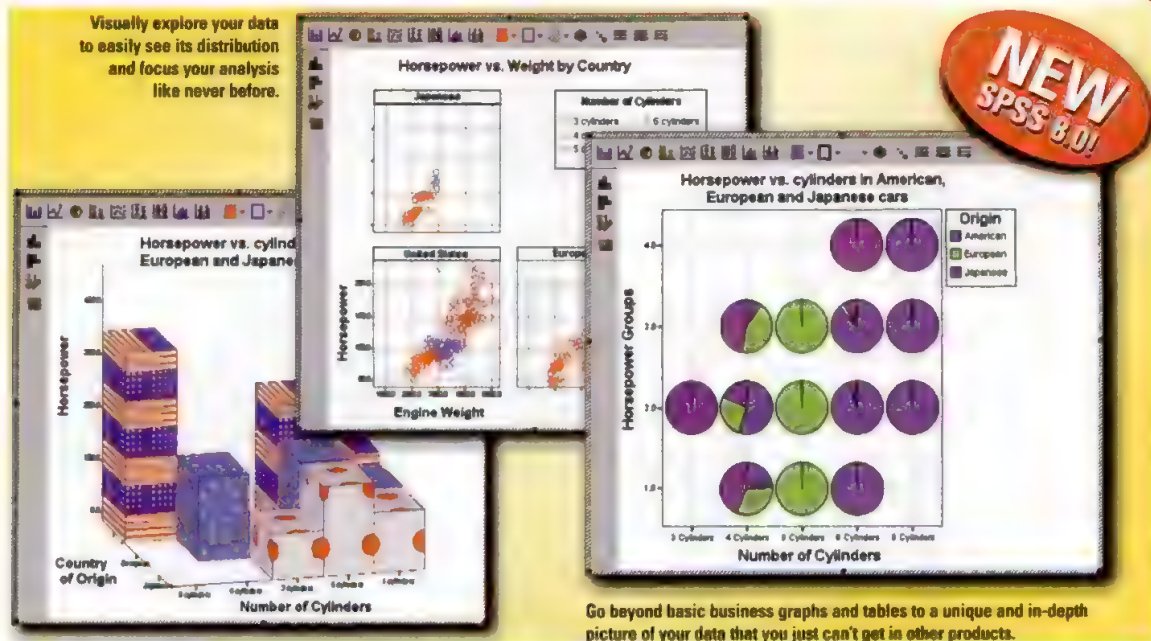
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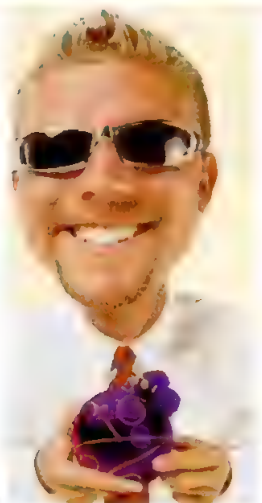
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D1702E, 17"/16.1" screen/view, 1024 x 768 resolution @ 75Hz, 28mm dp WY261662	E070, 17"/15.8" screen/view, 1024 x 768 resolution @ 75Hz, 28mm dp CMPE070
D1717, 17"/16.1" screen/view, 1280 x 1024 resolution @ 85Hz, 26mm dp WY261663	E072, 17"/15.8" screen/view, 1024 x 768 resolution @ 75Hz, 26mm dp CMPE072
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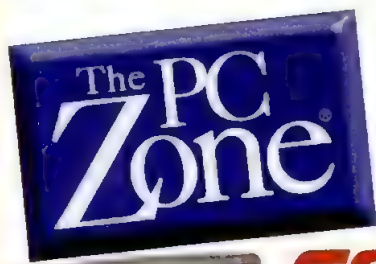
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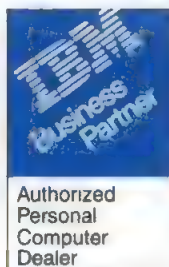
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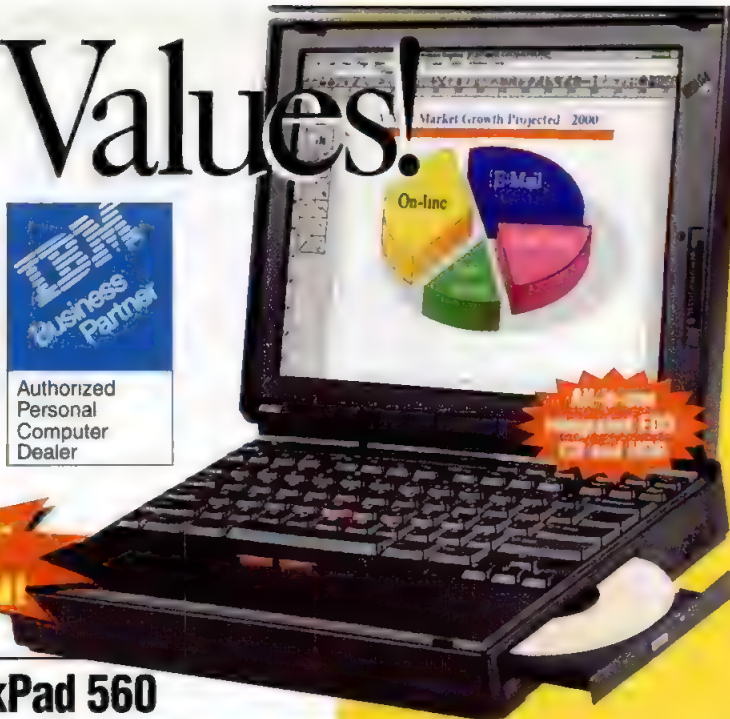
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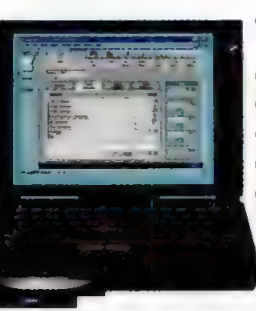


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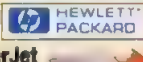
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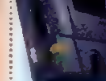
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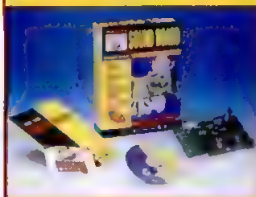
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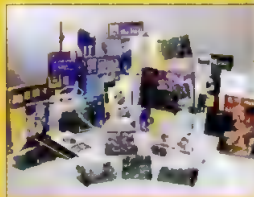
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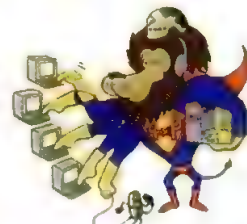
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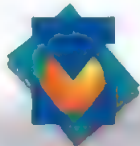
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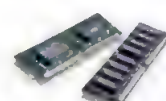
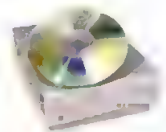
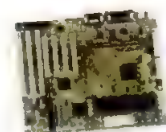
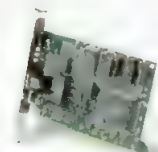
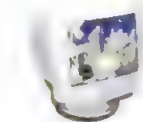
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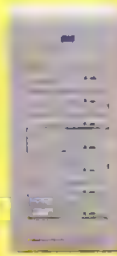
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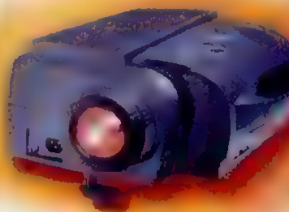
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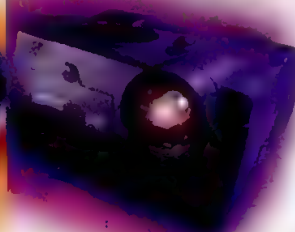
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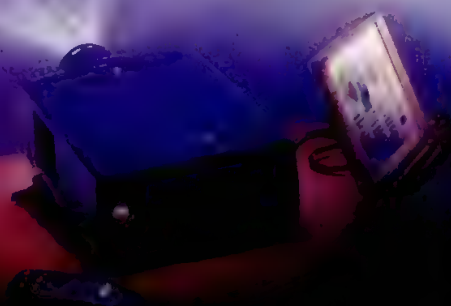
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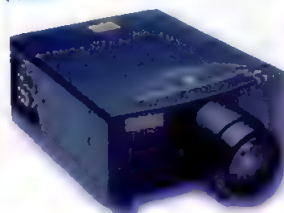
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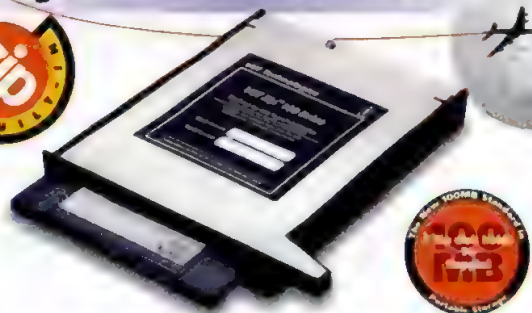
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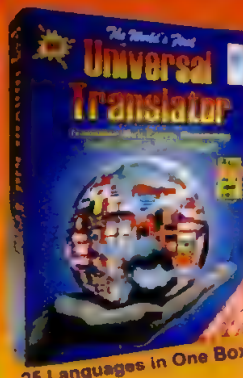
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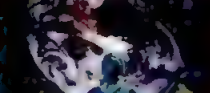


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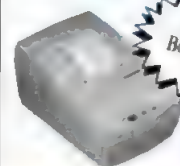
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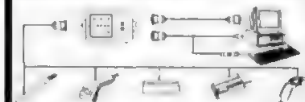
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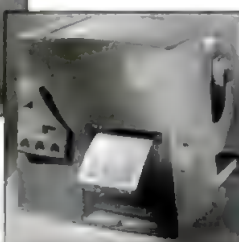


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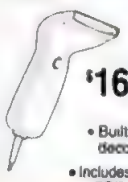
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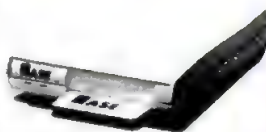
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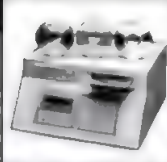
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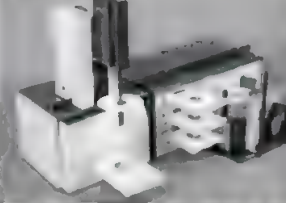
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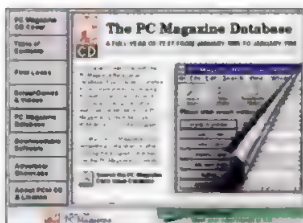
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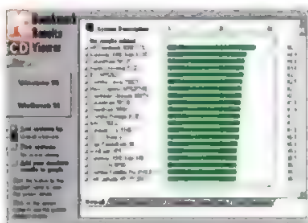
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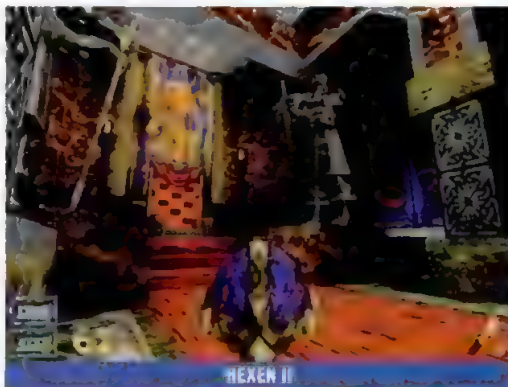
First-Person Finery

Two new action games offer excellent graphics and game play, and both require more than mere reflexes.

When DOOM burst on the scene a few years back, clones of the archetypal action game were plentiful and, for the most part, forgettable. LucasArts' Dark Forces and Raven Software's Heretic rose above their mundane rivals, however, to establish a new level of quality in the genre. It seems only appropriate, then, that descendants of these two games are now poised to elevate the genre again.

Activision's Hexen II and LucasArts' Jedi Knight: Dark Forces II each provide a rich, compelling first-person action experience that goes beyond the typical mindless fare. Each offers excellent graphics, game play, level design, sound effects, music,

and (of course) multiplayer support. But most important, each is based on an intricate story that provides a solid context for the action.



Die-hard Duke Nukem 3D and Quake fans should take note, though: Both games are heavy on puzzle solving as well as shoot-'em-up action. If you'd rather just shoot your way through a game, these aren't for you.



Hexen II

We've always been impressed by the artistic talent at Raven Software (now owned by Activision), but nothing in the past could have prepared us for the visual feast that is Hexen II. The final chapter of a trilogy, Hexen II is the best-looking first-person action game we've seen to date.

As in Heretic and Hexen, the story line in Hexen II pits you against one of the evil Serpent Riders, in this case Eidolon. In your quest to defeat Eidolon, you must liberate four vastly different lands and battle more than a dozen different types of creatures. Did we mention that Eidolon's minions include the Four Horsemen of the Apocalypse?

The game requires a Pentium/90 with 16MB of RAM, but we strongly recommend at least a Pentium/166 with 32MB of RAM and a 3Dfx-based 3-D accelerator board.

Hexen II is based on the Quake engine, but you won't ever confuse the two games. In Quake, everything was rendered in earth tones, and the level design had little to do with real-world architecture. By contrast, Hexen II features a much broader palette and some of the best level designs we've seen. Each of the game's



four lands has a unique look that is inspired by a different historical culture. The first is Blackmarsh, styled after medieval European architecture. The other lands are styled after ancient civilizations: Mazaera (Mesoamerican), Thysis (ancient Egyptian), and Septimus (Greco-Roman).

You fight your way through these lands as one of four different character types: Assassin, Crusader, Necromancer, and Paladin. Each has a unique set of (four) weapons and abilities. We prefer the Crusader for power and versatility.

Fans of Heretic and Hexen will be happy to know that Hexen II still uses an inventory

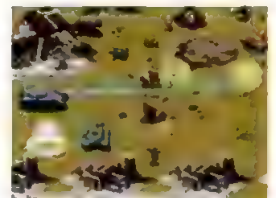
INSIDE

MORE STAR WARS

Grab your 3-D board and your blaster for this arcade game. *Page 512.*

WARP-CORE BREACH

"Star Trek" fans should be wary of Interplay's new space simulator. *Page 512.*



▲THE DELUGE BEGINS

The first three real-time games for the holiday season are here. *Page 516.*

After Hours

system and has added an experience-level system. The inventory consists of artifacts you'll find during your quest, while experience levels allow your character to grow more powerful as you progress.

As in *Hexen*, the levels in *Hexen II* are based around central hubs, and you must go back and forth between the levels to liberate each land. The enemies in each are tough to defeat, but equally tough are the many puzzles you must solve on your way. Although these puzzles require a lot of legwork to solve, they are generally easier than those in *Hexen*.

One of our few complaints about the game is that it did not run smoothly on our system (a Pentium/166 with 32MB of RAM) at any unaccelerated resolution above 320-by-200. Also, *Hexen II* often crashed after we had conquered each land. (Lesson: Save your game often.) We expect the crash bug to be fixed in a forthcoming patch, however, and if you are using an OpenGL-compliant 3-D accelerator board, the performance problem is a nonissue.

Overall, this game is a near-perfect achievement in the first-person action genre. If you like great graphics and challenging puzzles with your melee, you'll really love *Hexen II*.—*Michael E. Ryan*

Jedi Knight: Dark Forces II

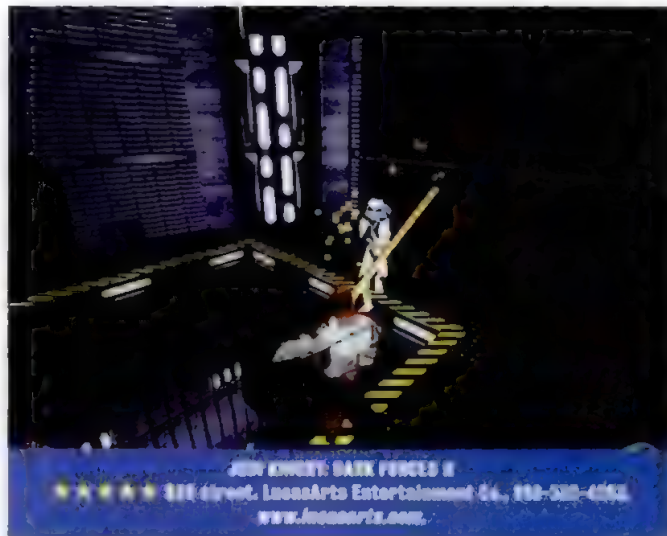
Kyle Katarn's work is never done. In *Dark Forces*, he only captured the plans to the Death Star and thwarted the Empire's plot to unleash Dark Troopers on the galaxy. Now in *Jedi Knight: Dark Forces II*, he

must avenge the murder of his father, learn the ways of the Jedi, and defeat the sinister Jerec—a Dark Jedi bent on



resurrecting the Empire.

Simply put, *Jedi Knight* is as good a game as you're likely to play. The title boasts a number of outstanding qualities, including the best story line, best level design, and best weapon we've seen in a first-person game (the weapon being a light saber). It even runs well on moderately equipped PCs—at least a Pentium/133 with 16MB of RAM and a Microsoft Direct3D-compliant 3-D accelerator for optimum performance.



The game starts out with you in a cantina, having just learned that an evil android possesses an object that could uncover the location of the

legendary Valley of the Jedi—a source of immense power. This is the information that Jerec seeks and that your father died to protect. You can either become a Light Jedi and stop Jerec or turn to the Dark Side and beat him to it. Choosing your own fate in this way enhances an already excellent game.

Your development as a Jedi is gradual. As you move through the game, you will acquire new and more powerful skills (including the old Jedi mind trick). You have to learn these skills with little or no guidance, a fact that will surely leave *Star Wars* purists wondering. But Luke Skywalker did it with the help of a Muppet and a ghost, so why can't you become a Jedi on your own? The skills you

In addition to the light saber, you have eight other weapons at your disposal throughout the game—including most of the ones found in the original *Dark Forces*.

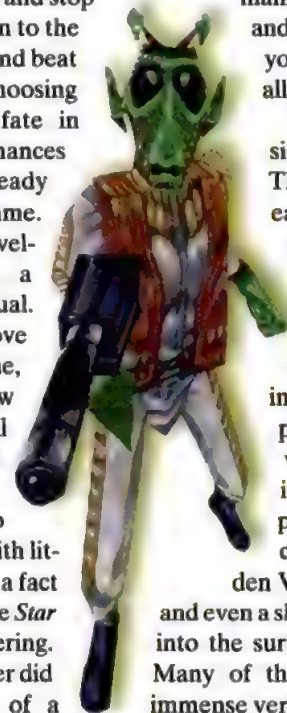
And as you face all manner of alien scum and Imperial forces, you'll find you need all these weapons.

The game consists of 21 levels. The artwork for each level is consistent with the look of the *Star Wars* movies, and these environments immerse you completely in that universe. The levels include a spaceport city, a deep canyon, the hidden Valley of the Jedi, and even a ship that's crashing into the surface of a planet. Many of the levels include immense vertical drops, so be aware that this game may very well terrify players with acrophobia.

The 3-D engine screamed along and looked great on our Pentium/166. Some of the characters are a bit blockier than those in *Hexen II* or even in *Quake*, but we scarcely noticed detached polygons while we were deflecting laser bolts with our light saber—easily the coolest feature in a very cool game.

Jedi Knight also includes two features that were sorely missing in *Dark Forces*: support for mid-level saved games and multiplayer death matches. Its multiplayer support is outstanding and highly customizable.

The Force is clearly with *Jedi Knight*, a game so impressive that we wholeheartedly recommend it to any gaming fan.—*MER*



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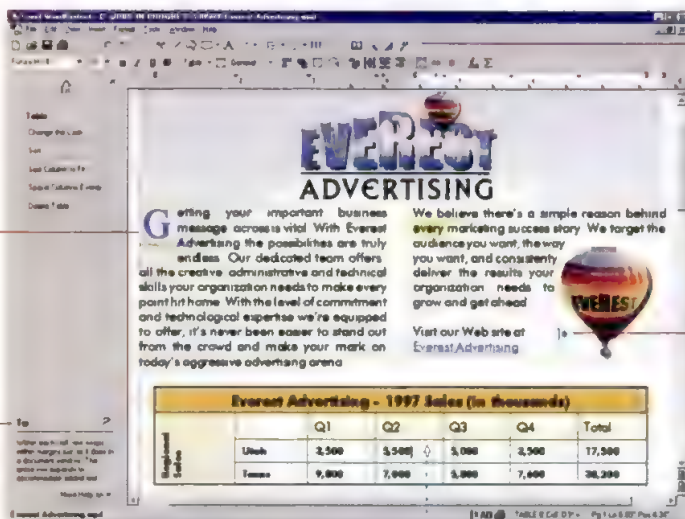
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May the Port Be with You

The Nintendo 64 hit looks great on the PC, but the game play is still average.

Shadows of the Empire

In case you missed it, George Lucas recently rereleased a new and improved *Star Wars* saga, fixing many of the things that he felt were wrong with the original production. Now, his namesake software company is rereleasing, or porting, *Shadows of the Empire*—a best-selling Nintendo 64 game—for the PC. LucasArts did a good job of improving the look of the game, but *Shadows* still suffers from problematic control and mediocre game play.

Shadows is a Windows 95 game that requires a 3-D accelerator board to run. It will take advantage of Microsoft's Direct3D API—but only with



boards built around the NEC PowerVR, Rendition Verite, and 3Dfx Voodoo chip sets. With a 3Dfx board, you'll need

a Pentium/90 with 16MB of RAM. For the other two chip sets, the game requires a Pentium/133. Still, we suggest a Pentium/166 or better.

As you well might expect, the graphics are outstanding.

Also, the cinematic sequences are phenomenal. As an added bonus, *Shadows* took full advantage of our Microsoft

SideWinder Force Feedback Pro joystick, which let us feel crashes, the impact of laser bolts, and other effects.

The game is split into ten levels, and it's heavy on arcade-style game play. In the first level, you get to control a Rebel snow speeder during the Battle of Hoth (from *The Empire Strikes Back*). Unfortunately, this is the best level in the game. The rest are decent and reasonably exciting, but we had a hard time with the controls on most of them. Six of the remaining nine levels have you controlling hotshot Dash Rendar from a third-person perspective. These levels look and feel a little like *Tomb Raider* but aren't quite as good.

In the end, *Shadows of the Empire* is a good game, not a great one. Still, *Star Wars* fans should enjoy this title, as will anyone looking to show off the power of a new 3-D board.—*Shane Mooney*

Red Alert

After three years, Interplay's epic "Star Trek" game limps out of space dock.

Starfleet Academy

At the 1996 Electronic Entertainment Expo in Los Angeles, Interplay gave the press a sneak peek at its next big project, *Starfleet Academy*. Based on that impressive preview and subsequent updates, the game certainly lives up to its billing as "the most anticipated 3-D space sim of the year." Unfortunately, it must also bear the label of biggest disappointment in recent gaming history.

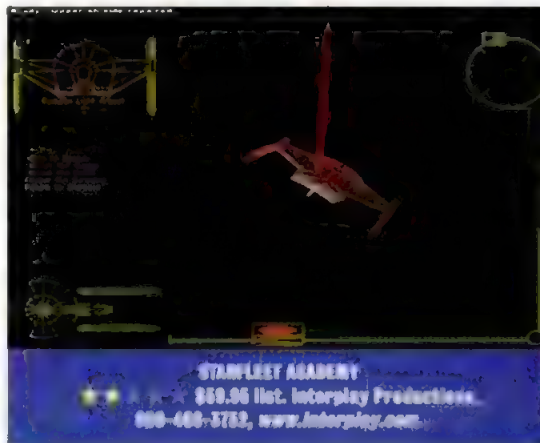
Starfleet Academy runs on Windows 95 and requires a

Pentium/90 with 16MB of RAM. We recommend a Pentium/166 with a 3-D accelerator, however, to take advantage of the game's Microsoft Direct3D support.

This product attempts to simulate the fictional experience of attending the prestigious Starfleet Academy. You enter as David Forrester, newly qualified command candidate and all-around bright guy. During your tenure at the school, you can hang out in the cadet lounge, chat with Admirals Kirk and Sulu, and, of course, fly simulated combat missions.

Starfleet Academy boasts of being a simulation that teaches you the ins and outs of

commanding large, ponderous starships. But the game plays more like an arcade-style space shoot-'em-up. Who knew the *Enterprise* was so spry? In this game, it flies like



an F-16. Worse, flying an *Excelsior*-class ship feels no different from piloting a space shuttle.

The simulator missions

seem simple at first, but most dissolve into ridiculously confusing efforts to find an obscure mission objective. The cinematic sequences between missions are pretty good, though some are cheesy in the extreme.

Finally, controlling different aspects of your ship isn't easy. If you need to do something daring—like rerouting power to shields in a battle—you might as well just initiate the self-destruct sequence.

If you take this unit for what it is—a cheesy "*Star Trek*" arcade game—it's pretty good. But if, like us, you were expecting a *Constitution*-class simulation, we can only say "It's dead, Jim."—*SM and MER*

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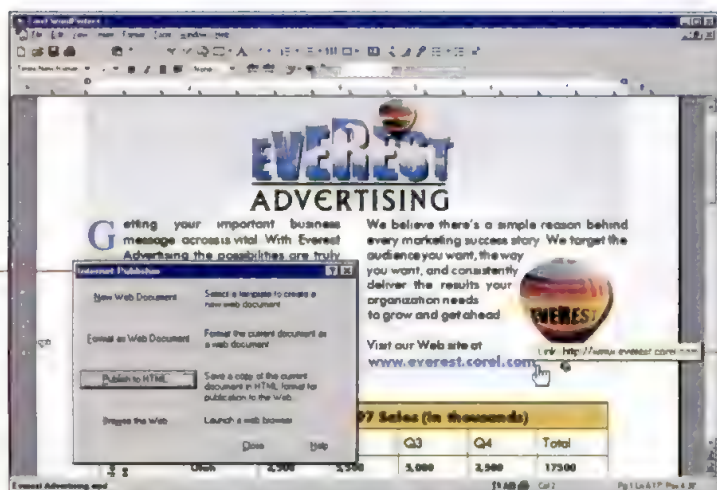
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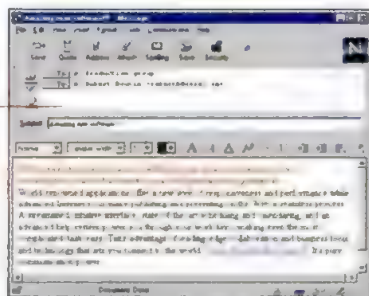
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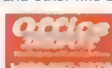
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Real-Time Roundup

These three titles mark just the first wave of a real-time strategy deluge this year.

This holiday season, roughly 60 real-time strategy games are scheduled to hit the shelves. The three Windows 95 titles here are among the first to ship. Each is very similar to *Command & Conquer*, *Dune II*, and *Warcraft* but adds a few twists to claim some measure of individuality. Of the three, however, we feel that only *Total Annihilation* has a chance of rising to the top in this year's real-time-strategy crop.

Dark Colony

To quote Benjamin Disraeli, "It is wretched taste to be gratified with mediocrity when the excellent lies before us." Judging from our look at *Dark Colony*, we're pretty certain that he would have found this game in pretty wretched taste. There is nothing terribly wrong with *Dark Colony*. In fact, it's a perfectly competent game. But when compared with other real-time games, there's nothing right with it, either.

Dark Colony was developed by ailing Gametek and picked up by Strategic Simulations after the fact. It's a decent enough strategy game with some satisfactory graphics and painfully familiar real-time combat. The title will run on a Pentium/90 with 16MB of RAM, but we recommend a Pentium/133 or better.

The setup and background

are effective, with an extremely gory introduction to set the tone. Humans finally come to colonize Mars, but aliens have already taken over the planet

process. Building structures and collecting resources follow traditional patterns. The only diversions from normal real-time fare are the gore when units die off and the funky aliens and their buildings, disturbingly similar to certain unmentionable parts of the human anatomy.

Dark Colony is extremely average. Offering little that's new besides looks, the product falls toward the back end of the pack. It takes a lot more than slick visuals to succeed in this genre.—T. Liam McDonald

7th Legion

The rule for the new crop of real-time strategy games is

just to repeat the *Command & Conquer*/*Dune II*/*Warcraft* design with one or two minor variations. A game like *7th Legion* is supposed to give gamers the illusion that they aren't doing the same thing over and over again. If only it were that easy!

The perspective is the now

all-too-familiar top-down view on a futuristic landscape, with little guys scampering around and shooting at each other. The graphics

are fairly compelling, and the system requirements of a Pentium/100 and 16MB of RAM are reasonable. Multiplayer support is available for up to six gamers via Internet, LAN, or modem.

The plot of the story pits the 7th Legion of Earth forces against the Chosen, a returning army that fled the planet years before. You can play as either the Legion or the Chosen, with five common unit types for each, eight additional types for the Chosen, and nine more for the Legion. Infantry and tanks make up the bulk of the armies, and large battle chassis bristling with weapons lead the forces. There are neither air nor sea units, but large bombs can be detonated with devastating results. Units can be assigned to groups and given move-and-attack orders at various settings: normal, defensive (run away), or aggressive (kill 'em all). Sadly, there is no waypoint feature.

The pacing is faster and more action-oriented than in many real-time games. In a novel twist giving *7th Legion* a slight edge, action cards can be played as special modifiers. There are 50 of these cards, and a player can have 5 at a time. Some provide attacks; others strip units of their skills and

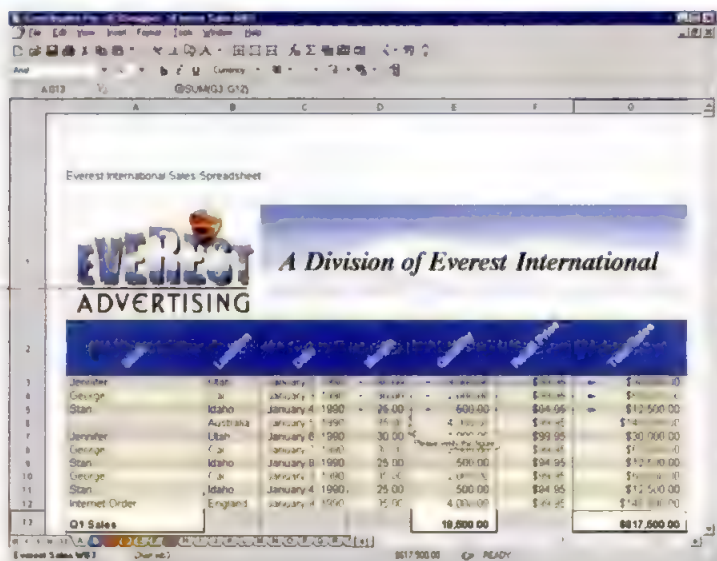


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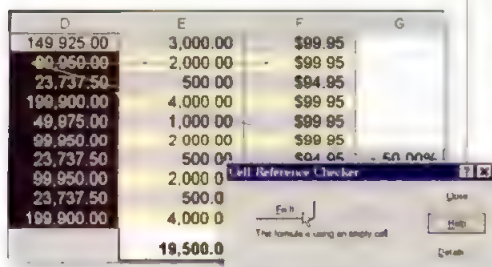
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add defensive ratings.

Resources are awarded intermittently, so the focus is on fighting. There are 40 missions within the campaigns but no single scenarios. If you're looking for a faster-paced Command & Conquer with less resource management and some random magic elements, 7th Legion is a fair bet.—TLM

Total Annihilation

Cavedog Entertainment's Total Annihilation is a good example of what can be done to breathe life into a tired genre. This well-designed title pits two factions against each other in the final stages of a 4,000-year-old struggle.

Graphics are this game's most impressive trait—all the more so because Total Annihilation is able to run on a Pentium/100 with 16MB of RAM. We recommend at

taintop and have enemies pass right below without noticing it. Weapons are similarly affected: For example, you can lob shells over a hill to destroy unwitting bad guys.

Each of the different unit types is well rendered and looks great in action. Aircraft bank gracefully during turns, while their underbelly cannons rotate to track targets.

And the unit types are plentiful. The game includes 150 different ones, and Cavedog plans to post new types periodically on its Web site (www.cavedog.com).

Large and diverse maps take you across radically different landscapes such as volcanic worlds, ice planets, desert valleys, mechanical worlds, alien tundra, towering mountain peaks, and vast, island-dotted oceans. A wide array of unit commands gives you complete



least a Pentium/133, but even that is a modest requirement these days.

Thanks to the game's 3D-rendered terrain, Total Annihilation is the best-looking game in the genre. Its screen looks like a highly detailed topographic map. The terrain is more than just eye candy, too. You can send a tank to a moun-

tain and have enemies pass right below without noticing it. Also, there are 25 single-player missions, as well as solid multiplayer support to ensure you get your money's worth.

With its great looks, cool features, and better-than-average game play, Total Annihilation could be the sleeper hit of the 1997 real-time deluge.—SM **PC**

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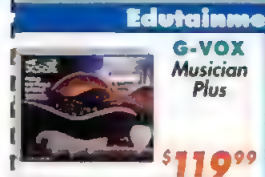
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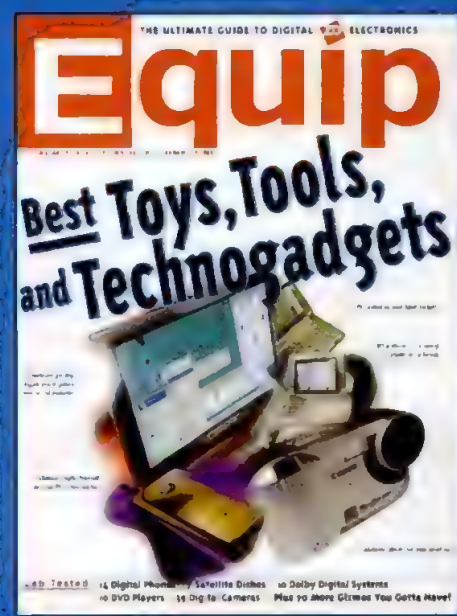
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You won't want to miss this summary of our 14th Annual PC Magazine Awards for Technical Excellence. We recognize the products—in all areas of PC computing—that push the technical envelope and point the way to the future.

Home PCs

You may be ready to consider a new home PC system. Trying to keep your spending down to around \$1,000 or less? Check here for our annual roundup of PCs for the home market in just that price range. We look at features, performance, ease of setup, included software, and service and support.

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It's a good time to start thinking about digitizing your family's photos—whether you scan them in, pay to have them digitized, or use a digital camera. One benefit of digitizing the photographs in your life is that you gain the ability to work with the images right on your PC. We review low-end image-editing packages aimed at helping you get started.



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● INTERNET OR NETWORK PROTECTION

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✓ VOLTAGE PROTECTION

✓ POWER SURGE GUARD

✓ INTERNET LINE PROTECTION

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*Pentium II has ATI 3D RAGE PRO AGP video. All OEM packaged without retail box.

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- Two USB Ports
- Infrared IrDA Connector
- 512K Pipelined Burst Cache
- 4 PCI/4 ISA Expansion Slots (Pentium II has 5 PCI/2 ISA & AGP)
- 9-Bay Mid-Tower Case
- Triple-Fan Cooling System (Extra Fan in front of case)
- 200-Watt Power Supply (Pentium II has 300-Watt)
- 3.5" 1.44MB Diskette Drive
- Dual Channel I/O Controller

IBM 6x86MX 233 System

- IBM 6x86MX PR233 MMX CPU
- 32MB High-speed SDRAM
- 4.3 GB Ultra DMA/33 Hard Disk
- ATI Xpression 3D Video
- 4MB Video Memory
- 24X CD-ROM Drive
- BOCA 56K Voice/Fax/modem
- 16-bit 3D Wave Table Sound
- Yamaha Hi-Fidelity Speakers
- ATX Motherboard with Case
- Microsoft IntelliMouse
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AMD-K6 233 MMX System

- AMD-K6 233MHz MMX CPU
- 32MB High-speed SDRAM
- 4.3 GB Ultra DMA/33 Hard Disk
- ATI Xpression 3D Video
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- 24X CD-ROM Drive
- BOCA 56K Voice/Fax/modem
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Pentium 233 MMX System

- Intel Pentium 233 MMX CPU
- 32MB High-speed SDRAM
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- BOCA 56K Voice/Fax/modem
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- Intel Pentium II 266 MMX CPU
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- 4.3 GB Ultra DMA/33 Hard Disk
- ATI 3D RAGE PRO AGP 2X Video
- 4MB Video Memory
- 24X CD-ROM Drive
- BOCA 56K Voice/Fax/modem
- 16-bit 3D Wave Table Sound
- Yamaha Hi-Fidelity Speakers
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- Microsoft IntelliMouse
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Pentium II 300 MMX System

- Intel Pentium II 300 MMX CPU
- 64MB High-speed SDRAM
- 6.4 GB Ultra DMA/33 Hard Disk
- ATI 3D RAGE PRO AGP 2X Video
- 4MB Video Memory
- 24X CD-ROM Drive
- BOCA 56K Voice/Fax/modem
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Abort, Retry, Fail?



The Microsoft Hillbillies

Do a spell-check on the name *Jethro* in Microsoft Word and you'll get back *Dieter* as a possible alternative. That's pretty weird unless you ponder an obscure

bit of movie trivia: In the 1993 movie version of "The Beverly Hillbillies," the part of Jethro was played by an actor named Dietrich Bader (who happens to be married to a childhood friend of your correspondent). An iron-clad explanation?

No, but it's as good as we can do. Other explanations are invited.



Now How Did This Happen?

A new book called *Your Personal NetGuide* (ISBN: 0-440-22390-3) carries a laudatory blurb from *PC Magazine* at the top of its front cover, but we'll give you one guess as to which leading computer-magazine Web site is listed nowhere among the 5,000 site reviews included in the 725-page tome. Hint: Its URL is www.pcmag.com.



Daffy Dictionary Definitions

"Windows 95: *n.* 32-bit extensions and a graphical shell for a 16-bit patch to an 8-bit operating system originally coded for a 4-bit microprocessor, written by a 2-bit company that can't stand 1 bit of competition."



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The 1997 ARF Census

Every year at this time, we sort through our towering stacks of files to figure out which types of Abort, Retry, Fail? submissions were the most prevalent. Then we encourage you not to send any more of those types, but you keep on sending them anyway, making the 1997 list look a lot like the 1996, 1995, 1994, and 1993 lists. So remember: If you want to win at the game of ARF, strive for originality and inventiveness; if the item comes from the Associated Press, *Parade* magazine, or a CompUSA flyer, chances are you won't be the first person to send it in. Here are the three most frequent ARF submissions for 1997:

- the news story about an Issaquah, Washington, man who shot his computer in a fit of anger;
- the Autodesk ad that misspells *accuracy* while discussing accuracy;
- classified ads that misspell *floppy* as "sloppy" or *NetWare* as "Netwear."

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802 or send e-mail (text items only) to don_willmott@zd.com. Winners this issue: Steve Hiner and John Pilge.



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